

AD A109220

OHIO RIVER BASIN
LITTLE SANDY CREEK, FAYETTE COUNTY

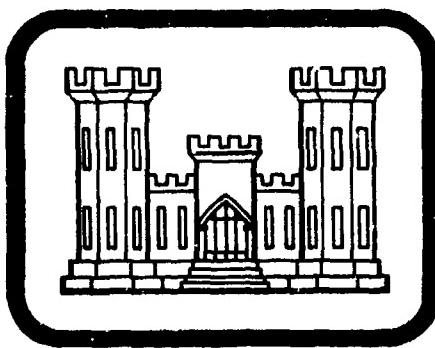
PENNSYLVANIA
HERITAGE RESERVATION DAM

NDI ID. NO. PA-01142
PENNDR ID. NO. 26-101

LEVEL II

ALLEGHENY TRAILS COUNCIL
BOY SCOUTS OF AMERICA

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



DTIC
ELECTED
JAN 04 1982
S E D

PREPARED FOR
DACW31-81-C-0015
DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

PREPARED BY

GAI CONSULTANTS, INC.

570 BEATTY ROAD

MONROEVILLE, PENNSYLVANIA 15146

SEPTEMBER 1981

"Original contains color
plates: All DTIC reproductions
will be in black and
white."

This document has been approved
for public release and sale; its
distribution is unlimited.

81 12 28 222
471002

PAF

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the Spillway Design Flood is based on the estimated Probable Maximum Flood (greatest reasonably possible storm runoff) for the region, or fractions thereof. The Spillway Design Flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition, and the downstream damage potential.

Breach analyses are performed, when necessary, to provide data to assess the potential for downstream damage and possible loss of life. The results are based on specific theoretical scenarios peculiar to the analysis of a particular dam and are not applicable to other related studies such as those conducted under the Federal Flood Insurance Program.

Accession For	
NTIS GRA&I	<input checked="" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification <i>See on file</i>	
By _____	
Distribution/ _____	
Availability Codes _____	
Dist	Avail and/or Special
A	

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Heritage Reservation Dam: NDI I.D. No. PA-01142

Owner: Allegheny Trails Council, Boy Scouts of America
State Located: Pennsylvania (PennDER I.D. No. 26-101)
County Located: Fayette
Stream: Little Sandy Creek
Inspection Date: 1 July 1981
Inspection Team: GAI Consultants, Inc.
570 Beatty Road
Monroeville, Pennsylvania 15146

Based on a visual inspection, operational history, and available engineering data, the dam is considered to be in excellent condition.

The size classification of the facility is intermediate and the hazard classification is considered to be high. In accordance with the recommended guidelines, the Spillway Design Flood (SDF) is considered to be the PMF (Probable Maximum Flood). Results of the hydrologic and hydraulic analysis indicate that the facility is capable of passing and/or storing the PMF without overtopping the dam or dike. Consequently, the spillway is considered adequate.

It is recommended that the owner immediately:

a. Develop formal manuals of operations and maintenance to ensure continued proper care and regular maintenance of the dam and its appurtenances.

b. Observe the wet conditions along the downstream embankment bench at the main dam and along the downstream toe of the dike in all future inspections, specifically noting any turbidity and/or changes in flow rate. In addition, resume the program of instrumentation monitoring (piezometer and settlement movement readings)

Heritage Reservation Dam: NDI I.D. No. PA-01142

until steady state conditions develop and it can be concluded that the facility is functioning as designed.

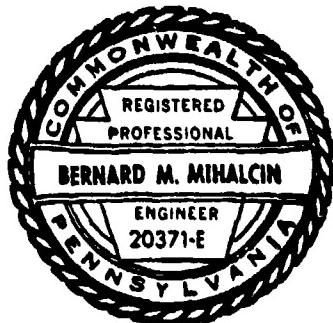
GAI Consultants, Inc.

Bernard M. Mihalcin
Bernard M. Mihalcin, P.E.

Approved by:

James W. Peck

James W. Peck
Colonel, Corps of Engineers
Commander and District Engineer



Date: 10 Sept 1981

Date: 18 Sept 1981



OVERVIEW PHOTOGRAPH

TABLE OF CONTENTS

	<u>Page</u>
PREFACE	i
ABSTRACT	ii
OVERVIEW PHOTOGRAPH.	iv
TABLE OF CONTENTS.	v
SECTION 1 - GENERAL INFORMATION.	1
1.0 Authority.	1
1.1 Purpose.	1
1.2 Description of Project	1
1.3 Pertinent Data	2
SECTION 2 - ENGINEERING DATA	6
2.1 Design	6
2.2 Construction Records	8
2.3 Operational Records.	8
2.4 Other Investigations	8
2.5 Evaluation	8
SECTION 3 - VISUAL INSPECTION.	10
3.1 Observations	10
3.2 Evaluation	11
SECTION 4 - OPERATIONAL PROCEDURES	12
4.1 Normal Operating Procedure	12
4.2 Maintenance of Dam	12
4.3 Maintenance of Operating Facilities.	12
4.4 Warning System	12
4.5 Evaluation	12
SECTION 5 - HYDROLOGIC/HYDRAULIC EVALUATION.	13
5.1 Design Data.	13
5.2 Experience Data.	13
5.3 Visual Observations.	13
5.4 Method of Analysis	13
5.5 Summary of Analysis.	14
5.6 Spillway Adequacy.	14
SECTION 6 - EVALUATION OF STRUCTURAL INTEGRITY	15
6.1 Visual Observations.	15
6.2 Design and Construction Techniques	15
6.3 Past Performance	15
6.4 Seismic Stability.	15
SECTION 7 - ASSESSMENT AND RECOMMENDATIONS FOR REMEDIAL MEASURES.	17
7.1 Dam Assessment	17
7.2 Recommendations/Remedial Measures.	17

TABLE OF CONTENTS

- APPENDIX A - VISUAL INSPECTION CHECKLIST AND FIELD SKETCHES**
- APPENDIX B - ENGINEERING DATA CHECKLIST**
- APPENDIX C - PHOTOGRAPHS**
- APPENDIX D - HYDROLOGIC AND HYDRAULIC ANALYSES**
- APPENDIX E - FIGURES**
- APPENDIX F - GEOLOGY**

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
HERITAGE RESERVATION DAM
NDI NO. PA-01142, PENNDR NO. 26-101

SECTION 1
GENERAL INFORMATION

1.0 Authority.

The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers to initiate a program of inspection of dams throughout the United States.

1.1 Purpose.

The purpose is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Heritage Reservation Dam is a 66-foot high earth embankment approximately 770 feet long. The structure is equipped with both service and emergency spillways. The service spillway is located along the upstream embankment toe near the center of the embankment. It is a single-stage, reinforced concrete, drop inlet-type, vertical riser connected to a 36-inch diameter, horizontal, concrete conduit at its base. The emergency spillway is a trapezoidal shaped channel cut through rock in the right abutment. The channel is 125 feet wide at its crest which is defined by a 18-inch thick concrete sillwall. The facility is provided with a reservoir drain consisting of a 36-inch by 48-inch intake situated along the upstream face of the service spillway riser. Flows through the intake are controlled by a 48-inch by 48-inch sluice gate that is manually operated from atop the riser. The riser is also equipped with a 6-inch diameter gate along its downstream face which is used to augment stream flows during periods of low pools.

In addition to the main embankment, a 27-foot high, 1,600-foot long earth dike, curved in plan, is constructed to protect a low area along the ridge at the perimeter of the reservoir northwest of the main embankment.

b. Location. Heritage Reservation Dam is located on Little Sandy Creek in Wharton Township, Fayette County, Pennsylvania. The facility is situated off U.S. Route 40 approximately 1.7 miles southeast of the community of Farmington, Pennsylvania. The dam and reservoir are contained within the Fort Necessity, Pennsylvania, 7.5 minute U.S.G.S. topographic quadrangle (see Figure 1, Appendix E). The coordinates of the dam are N 39° 45.2' and W 79° 33.1'.

c. Size Classification. Intermediate (66 feet high, 8,800 acre-feet storage capacity at top of dam).

d. Hazard Classification. High (see Section 3.1.e).

e. Ownership. Allegheny Trails Council
Boy Scouts of America
Flag Plaza
Pittsburgh, Pennsylvania 15219
Attn: Ronald E. Moranville
Secretary

f. Purpose. Recreation.

g. Historical Data. Heritage Reservation Dam was constructed in conjunction with Heritage Reservation, a 1,500-acre recreation facility developed by the Allegheny Trails Council of the Boy Scouts of America, Pittsburgh, Pennsylvania. The reservation provides a camping and outdoor activities facility for Boy Scout troops associated with Allegheny Trails Council. The dam was designed by D'Appolonia Consulting Engineers, Inc. of Pittsburgh, Pennsylvania and constructed by Engineered Construction International, Inc. (ECI), also of Pittsburgh. Construction began in June 1979 and was substantially completed by November of that same year. The facility has been in operation for just over one year. No significant problems have been incurred.

1.3 Pertinent Data.

a. Drainage Area (square miles). 5.8

b. Discharge at Dam Site.

Discharge Capacity of Reservoir Drain - Discharge capacity table contained in design report (see Appendix D, Sheet 3).

Discharge Capacity of Service Spillway at Maximum Pool ≈ 175 cfs (see Appendix D, Sheet 3).

Discharge Capacity of Emergency Spillway at Maximum Pool ≈ 10,570 cfs (see Appendix D, Sheet 4).

c. Elevations (feet above mean sea level). The following elevations were obtained from available drawings and through field measurements based on the elevation of the center of the emergency spillway crest at 2098.0 feet (see Appendix D, Sheet 1).

Top of Dam	2108 (design). 2108 (field).
Maximum Design Pool	2108
Maximum Pool of Record	Not known.
Normal Pool (Summer)	2096 (May 1 to Oct. 1).

Normal Pool (Winter)	2086 (Oct. 1 to Dec. 1).
Service Spillway Crest	2096
Service Spillway Outlet	
Invert	2044
Emergency Spillway Crest	2098
Reservoir Drain Invert	2058
Top of Dike	2108 (design). 2108.? (field).
Downstream Dike Toe	2080.8
Base of Impact Basin	2041.7
Streambed at Dam Centerline	2043

d. Reservoir Length (feet).

Top of Dam	7,300
Normal Pool	6,000

e. Storage (acre-feet).

Top of Dam	8,800
Normal Pool (Summer)	5,300
Normal Pool (Winter)	3,100

f. Reservoir Surface (acres).

Top of Dam	352
Normal Pool (Summer)	252
Normal Pool (Winter)	180

g. Dam.

Type	Zoned earth and rockfill.
Length	770 feet (excluding spillway).
Height	66 feet (field measured; embankment crest to base of impact basin).
Top Width	14 feet (design). 13 feet (field).
Upstream Slope (above normal pool)	2H:1V (design). 2H:1V (field).
Downstream Slope Upper	2.5H:1V (design). 2.5H:1V (field).
Lower	2.5H:1V (design). 2H:1V (field).

Width of Downstream Berm	17 feet (field. It is noted that design drawings indicate two 10-foot wide berms along the downstream embankment face. However, only the upper berm is clearly distinguishable in the as-built structure. See Figure 5 and Photograph 3).
Zoning	Four zones described in detail in Figure 5.
Impervious Core	Zone 1 is reportedly comprised of the more clayey and plastic material available from the borrow area.
Cutoff	20-foot wide trench reportedly excavated to rock along embankment centerline and backfilled with Zone 1 material.
Grout Curtain	Right abutment (see Figure 5).
h. Dike.	
Type	Zoned earth.
Length	1,600 feet.
Height	27 feet (field measured; dike crest to downstream dike toe).
Top Width	14 feet (design). 25 feet (field).
Upstream Slope (above normal pool)	2H:1V (design). 2H:1V (field).
Downstream Slope Upper	2.25H:1V (design). 2H:1V (field).
Lower	2.5H:1V (design). 2.5H:1V (field).

Width of Downstream Berm	10 feet (design). 10 feet (field).
Internal Features	The dike is zoned similarly to the main embankment (see Figure 7).
Grout Curtain	None indicated.
i. <u>Service Spillway.</u>	
Type	Single stage, reinforced concrete, drop inlet-type, vertical riser connected to a 36-inch diameter, horizontal, concrete conduit at its base.
Crest Elevation	2096.0 feet.
j. <u>Emergency Spillway.</u>	
Type	Trapezoidal shaped, grass lined channel cut through rock in the right abutment. Spillway crest is defined by an 18-inch wide concrete sillwall.
Crest Elevation	2098.0 feet.
Crest Length	125 feet.
k. <u>Reservoir Drain.</u>	
Type	36-inch by 48-inch opening along the upstream face of the service spillway riser (see Figures 8 and 9).
Invert Elevation	2058.0 feet.
Closure and Regulating Facilities	Control is provided by a 48-inch square slide gate mounted on the outside face of the service spillway riser and operated from atop the riser.

SECTION 2 ENGINEERING DATA

2.1 Design.

a. Design Data Availability and Sources. A complete documentation of the design and construction of Heritage Reservation Dam is contained in a set of five formal reports available from the owner, engineer and PennDER. These reports were prepared by D'Appolonia Consulting Engineers, Inc. of Pittsburgh, Pennsylvania, and include the following:

- "Design Report", dated May, 1979.
- "Design Calculations, Hydrologic and Hydraulic Analyses", dated June, 1979,
- "Addendum Design Report", dated July, 1979.
- "Construction Photographs", dated March, 1980.
- "As-Built Report", dated March, 1980.

b. Design Features.

1. Dam. Design and as-built features of the dam are presented in Figures 3 and 5 (Note: Some of the dimensions contained in the figures vary slightly from field measurements). As indicated, the structure was designed as a zoned earth and rockfill embankment. All visible portions of the embankment slopes consist of rockfill. The downstream embankment face is sloped at 2.5H:1V and was designed with 10-foot wide berms at elevations 2081 and 2057. The lower berm is covered with large sandstone type boulders and is fairly indistinguishable from the remainder of the slope. The upstream embankment face is sloped at 3H:1V below normal summer pool and 2H:1V between normal summer pool and the embankment crest. Rockfill covers a majority of the upstream face extending from the crest to elevation 2058.

The section depicted in Figure 5 shows typical as-built internal features of the embankment. The dam incorporates a central core zone of select material (Zone 1) consisting of the more clayey, more plastic materials available. Zone 2 material reportedly consists of low plasticity soils containing rock fragments of 9-inch diameter or less. An 18-inch wide vertical chimney drain and a series of horizontal underdrains are also provided.

The embankment foundation was reportedly stripped of essentially all overburden material to the top of the underlying weathered sandstone. A 20-foot wide cutoff trench was founded in either sandstone or shale along the axis of the dam.

2. Appurtenant Structures.

a) Dike. Design features of the dike are presented in Figures 4 and 7. As indicated, the structure was designed as a zoned earthfill embankment similar to the main dam. The dike is constructed with a cutoff trench along its centerline that is founded on weathered shale. A series of horizontal sand drains were installed in the foundation downstream of the cutoff trench. Materials used for the dike construction generally consisted of brown weathered shale and brown silty clay with rock fragments. The finished structure was hydroseeded and sandstone riprap was placed along the upstream dike face between elevations 2100 and 2084.

b) Service Spillway. Design features of the service spillway are presented in Figures 8 and 9. As indicated, the service spillway is a single-stage, drop inlet-type structure consisting of a reinforced concrete riser and a 36-inch diameter reinforced concrete discharge conduit.

c) Emergency Spillway. Design features of the emergency spillway are presented in Figures 3, 6 and 8. As indicated, the emergency spillway is a trapezoidal shaped channel cut in rock through the right abutment. The channel is about 800 feet long and has a base crest width of 125 feet. Its control section is defined by a 18-inch wide concrete sillwall imbedded 4 feet into the channel. The channel is provided with 10 feet of available freeboard between its crest and the top of the dam.

d) Reservoir Drain. Drawdown capability is provided by a 48-inch by 48-inch stainless steel gate that covers a 36-inch by 48-inch opening along the upstream face of the service spillway riser at elevation 2058. The gate is manually operated from atop the riser (see Figures 8 and 9).

c. Specific Design Data and Criteria.

1. Hydrology and Hydraulics. Specific data related to the hydrologic and hydraulic design of Heritage Reservation Dam are briefly discussed in Section 5.1 of this report.

2. Dam and Dike. Available design information includes all the basic elements of earth dam design. Embankment materials information with respect to local soils classifications, moisture-density relationships, consolidation, and permeability data are all presented in the various reports prepared by D'Appolonia.

Stability analyses of the dam and dike were conducted utilizing the STABL I computer program developed at Purdue University. The soil parameters utilized in the analyses were determined from laboratory tests on soil samples taken during the exploration program.

Loading conditions considered include:

- a) Long-term, steady-state seepage.
- b) Long-term, steady-state seepage with horizontal earthquake loadings of 0.1g.
- c) End of construction.
- d) Instantaneous reservoir drawdown from normal pool, elevation 2096, to elevation 2058, the invert of the water control gate.

The results of the analyses report that, for each loading condition, the minimum factors of safety determined were equal to or greater than the required factors of safety as recommended by the U.S. Army, Corps of Engineers.

3. Appurtenant Structures. The service spillway and reservoir drain designs incorporated into this facility are based on proven standards developed by the U.S. Department of Agriculture, Soil Conservation Service (SCS). Design data are presented in the design report.

2.2 Construction Records.

A fully documented construction history is contained within the reports entitled "As-Built Report" and "Construction Photographs", both dated March, 1980.

2.3 Operational Records.

No records of the daily operation of this facility are maintained. Instrumentation associated with the facility, such as piezometers and construction monuments, were monitored through October 1980 on a regular basis and the data are available from D'Appolonia. At present, the instrumentation is not being monitored on a regular basis.

2.4 Other Investigations.

No other formal investigations have been performed on this facility subsequent to its completion.

2.5 Evaluation.

Comprehensive engineering and construction data are available sufficient to indicate the structure was formally designed and

constructed in accordance with accepted modern engineering practices. Monitoring of the instrumentation was initiated during construction, but, was terminated in October 1980, shortly after reservoir fill-up. Reactivation of the monitoring program is recommended until it is determined that steady state conditions have developed within the embankment.

SECTION 3
VISUAL INSPECTION

3.1 Observations.

a. General. The general appearance of this project indicates the dam and its appurtenances are currently in good condition.

b. Dam. Observations made during the visual inspection indicate the dam is in excellent condition. No evidence of sloughing, erosion, excessive settlement, animal burrows, or signs of maintenance neglect were observed (see Photographs 1 and 2). Wet areas were observed at several locations along the downstream access berm (see Photograph 5); however, the condition could be the result of infiltration of the rock shell from overnight rains. Review of PennDER files indicated that the condition was observed previously and was described as "numerous point seeps". Discussions with the engineer and review of available piezometer data did not indicate clearly the source of this condition. Seepage and/or abutment leakage is visible at several other locations as indicated on the field sketch contained in Appendix A (see "Heritage Reservation Dam, General Plan - Field Inspection Notes"). None of the observed seepage is considered significant at this time.

c. Appurtenant Structures.

1. Dike. Based on visual observations, the dike is considered to be in excellent condition (See Photographs 9 and 10). No evidence of sloughing, erosion, seepage through the downstream dike face, settlement, animal burrows, or signs of maintenance neglect were observed. Wet conditions were observed along the downstream dike toe (see Photograph 11). However, this is probably the result of discharge through the horizontal finger drain system and is not considered to be significant.

2. Service Spillway. The service spillway drop inlet, reinforced concrete riser and outlet impact structure appear to be in excellent condition. No cracks or signs of weathering were observed on the exposed concrete surfaces of the structures. No evidence of corrosion was observed on exposed metal surfaces (see Photographs 6 and 7).

3. Emergency Spillway. Visual observations indicate that the emergency spillway is in good condition (see Photographs 3 and 4). Numerous leaks (\approx 50 to 60 gpm) were observed emanating from the bedrock foundation through which the channel is cut. At present, the observed condition is not considered to be significant.

4. Reservoir Drain. The reservoir drain is reportedly functional and in excellent condition. The control gate was not operated in the presence of the inspection team; however, it reportedly will be opened in the fall in order to lower the reservoir prior to the winter season.

d. Reservoir Area. The general area surrounding the reservoir is comprised of moderate to steep, heavily forested slopes. No signs of slope distress were observed.

e. Downstream Channel. The channels immediately downstream of both the dam and dike are characterized as steep and set in narrow valleys with steep and heavily forested confining slopes. The two streams converge less than 2.2 miles below the dam. About 1.6 miles further downstream, Little Sandy Creek flows through the community of Gibbon Glade, Pennsylvania. According to a downstream inundation map prepared by D'Appolonia (see Figure 10) as part of the "Emergency Warning System and Evacuation Plan" for this facility, as many as 17 separate structures, including homes and small businesses, could be affected by an embankment breach. It is estimated that approximately 50 lives could be affected by such an event. As a result, the hazard classification is considered to be high.

3.2 Evaluation.

Based strictly on visual observations, the general condition of the facility is considered excellent. Various wet conditions are associated with the dam and dike, but, for the most part, are considered to be minor deficiencies requiring regular observation rather than immediate remedial attention.

SECTION 4 OPERATIONAL PROCEDURES

4.1 Normal Operating Procedure .

Heritage Reservation Dam is essentially a self-regulating facility. Excess inflow passes through the service spillway and into the discharge stream. Inflows in excess of the capacity of the service spillway are stored and/or discharged through the emergency spillway. Under normal operating conditions the reservoir drain is closed between the months of December through September. Planned operating procedures call for the drain to be opened each October 1 in order to draw down the reservoir approximately 10 feet to winter pool at elevation 2086 feet. The drawdown is intended to provide the opportunity for repairs and other work necessary to maintain the recreational areas surrounding the reservoir. The drain is to be re-closed in early December of each year in order to assure full pool by the following May. No formal operations manual is available.

4.2 Maintenance of Dam.

The facility, as designed, requires only limited maintenance which can be performed, as needed, by the Heritage Reservation maintenance staff. No formal maintenance manual is available.

4.3 Maintenance of Operating Facilities.

See Section 4.2 above.

4.4 Warning System.

A formal plan entitled "Emergency Warning System and Evacuation Plan, Heritage Reservation Dam and Reservoir, Permit No. 2679605, Wharton Township, Fayette County, Pennsylvania", dated November 1, 1979, is available from both the PennDER and the owner (see Figure 10).

4.5 Evaluation.

The facility is designed to be self-regulating and requires minimal maintenance. A formal emergency warning system is available. In addition, a brief "Schedule of Operations" is contained in the original design report, dated May 1979. Both of the above should be incorporated into a formal operations and maintenance manual which should also include a formal schedule of maintenance.

SECTION 5 HYDROLOGIC/HYDRAULIC EVALUATION

5.1 Design Data.

A complete hydrologic/hydraulic analysis as prepared by the design engineer is available from PennDER files. The files contain all pertinent discharge rating curves and storage capacity curves for the facility, as well as all appropriate hydrograph and routing data.

The service and emergency spillways were designed such that the 100-year flood (4.25 inches rainfall in 6 hours) would pass through the service spillway without engaging the emergency spillway, and such that the PMF event (24.2 inches rainfall in 24 hours) would pass without overtopping the dam and appurtenant dike. The PMF inflow and outflow hydrographs were developed using the Dam Safety version of the HEC-1 computer program developed by the U.S. Army, Corps of Engineers, Hydrologic Engineering Center, Davis, California. The SCS loss rate procedure and dimensionless unit hydrograph options were employed in the HEC-1 analysis.

Due to difficulties encountered in the excavation of the emergency spillway channel, revisions were made to the original design, such that the width of the channel was reduced from 225 feet to 125 feet. Consequently, the design top of dam elevation was raised from 2106 feet to 2108 feet, in order to accommodate the PMF event without overtopping.

5.2 Experience Data.

The facility was completed in November 1979 and the emergency spillway has yet to discharge.

5.3 Visual Observations.

On the date of inspection, no conditions were observed that would indicate the spillway could not perform satisfactorily during a flood event, within the limits of its design capacity.

5.4 Method of Analysis.

The facility has been analyzed in accordance with the procedures and guidelines established by the U.S. Army, Corps of Engineers, Baltimore District, for Phase I hydrologic and hydraulic evaluations. The hydrologic and hydraulic design calculations pertaining to the sizing of the dam and the service and emergency spillways, contained in the design reports, were evaluated in order to ensure compliance with the recommended guidelines.

5.5 Summary of Analysis.

a. Spillway Design Flood (SDF). In accordance with the procedures and guidelines contained in the National Guidelines for Safety Inspection of Dams for Phase I Investigations, the Spillway Design Flood (SDF) for Heritage Reservation Dam is the Probable Maximum Flood (PMF). This classification is based on the relative size of the dam (intermediate), and on the potential hazard of dam failure to downstream developments (high).

b. Results of Analysis. The service and emergency spillways at Heritage Reservation Dam were designed to accommodate the PMF prior to embankment overtopping. The service spillway consists of a standard SCS reinforced concrete, drop inlet-type riser structure, connected to a 36-inch diameter, reinforced concrete outlet conduit. The emergency spillway consists of a trapezoidal shaped channel cut in rock at the right abutment.

According to data contained within the design report, under PMF conditions, the peak inflow into the reservoir was approximately 25,160 cfs. The resulting peak outflow was about 10,610 cfs, corresponding to a maximum reservoir elevation of approximately 2107.9 feet, or 0.1-foot below the top of the dam. The spillway discharge rating curves, storage capacity curves, and the HEC-1 summary input and output are provided in Appendix D.

5.6 Spillway Adequacy.

Since the reservoir and spillway system at Heritage Reservation Dam are capable of accommodating the PMF (SDF) without overtopping of the dam and/or dike, the spillway system is deemed adequate.

SECTION 6
EVALUATION OF STRUCTURAL INTEGRITY

6.1 Visual Observations.

a. Dam. Based on visual observations, the dam is considered to be in excellent condition. Construction photographs and reports indicate the facility was well constructed. The source of the wet areas along the downstream bench could not be determined based strictly on observations and available piezometer data. Consequently, a regular program of instrumentation monitoring and observation is considered necessary in order for any changes in existing conditions to be recorded and evaluated.

b. Appurtenant Structures.

1. Dike. The dike was also observed to be in excellent condition. Ponding observed at the downstream toe is likely due to discharge from the horizontal finger drain system and is not considered to be significant at present.

2. Service Spillway. Concrete structures (riser and impact basin) associated with the service spillway were observed to be in excellent condition. No cracking, spalling or other types of concrete deterioration were evident.

3. Emergency Spillway. The emergency spillway was observed to be in good condition. Substantial seepage was noted throughout the discharge channel. The channel is primarily cut into resistant sandstone, and therefore, the seepage is not considered to be a detriment to its operation.

6.2 Design and Construction Techniques.

Design, as-built and construction reports confirm that the facility was designed and constructed in accordance with accepted modern standards.

6.3 Past Performance.

Discussions with the owner's representative and engineer indicate the facility has performed adequately since its completion.

6.4 Seismic Stability.

The dam is located in Seismic Zone No. 1 and may be subject to minor earthquake induced dynamic forces. The design report indi-

cates the facility was designed to resist expected earthquake induced dynamic forces.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS FOR REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The results of this investigation indicate the facility is in excellent condition.

The size classification of the facility is intermediate and the hazard classification is considered to be high. In accordance with the recommended guidelines, the Spillway Design Flood (SDF) is considered to be the PMF (Probable Maximum Flood). Results of the hydrologic and hydraulic analysis indicate that the facility is capable of passing and/or storing the PMF without overtopping the dam or dike. Consequently, the spillway is considered adequate.

b. Adequacy of Information. The available data is considered sufficient to make a reasonable Phase I assessment of the facility.

c. Urgency. The recommendations listed below should implemented immediately.

d. Necessity for Additional Investigations. No additional investigations are considered necessary at this time.

7.2 Recommendations/Remedial Measures.

It is recommended that the owner immediately:

a. Develop formal manuals of operations and maintenance to ensure continued proper care and regular maintenance of the dam and its appurtenances.

b. Observe the wet conditions along the downstream embankment bench at the main dam and along the downstream toe of the dike in all future inspections, specifically noting any turbidity and/or changes in flow rate. In addition, resume the program of instrumentation monitoring (piezometer and settlement movement readings) until steady state conditions develop and it can be concluded that the facility is functioning as designed.

APPENDIX A
VISUAL INSPECTION CHECKLIST AND FIELD SKETCHES

**CHECK LIST
VISUAL INSPECTION
PHASE 1**

NAME OF DAM	Heritage Reservation Dam	STATE	Pennsylvania	COUNTY	Fayette
NAME & PA	01142	PENNDEMR#	26-101	HAZARD CATEGORY	High
TYPE OF DAM	Earth	SIZE	Intermediate	TEMPERATURE	65° 10:00 a.m.
DATE(S) INSPECTION	1 July 1981	WEATHER	Overcast		
POOL ELEVATION AT TIME OF INSPECTION	2006.3 feet		M.S.L.		
TAILWATER AT TIME OF INSPECTION	N/A		M.S.L.		
OTHERS					
OWNER REPRESENTATIVES					
INSPECTION PERSONNEL					
B.M. Mihalcin	Heritage Reservation				
D.J. Spaeder	Karl H. Lerz - Director				
D.L. Bonk	of Properties and Development				
RECORDED BY D.L. Bonk					

EMBANKMENT

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS	NDI# PA - 011A2
SURFACE CRACKS	None observed.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed.	
SLoughing or Erosion of Embankment and Abutment Slopes	None observed.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Horizontal - good. Vertical - good (see profiles of dam and dike crests contained in Appendix A).	
RIPRAP FAILURES	Entire dam embankment is covered with sandstone boulders. Good condition. No riprap failures were observed.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Good condition.	

EMBANKMENT

ITEM	OBSERVATIONS	REMARKS/RECOMMENDATIONS	NDI PA • 01142
DAMP AREAS IRREGULAR VEGETATION (LUSH OR DEAD PLANTS)	Some minor ponding and general wet conditions were observed across the access berm situated along the downstream embankment face. Most of the water appears to be surface runoff generated by heavy overnight rains. Some of the observed moisture may be attributable to point seeps beneath the rock cover; however, this was not confirmed during the inspection.		
ANY NOTICEABLE SEEPAGE	None observed through the downstream embankment face (see above). Minor abutment seepage evident at the left abutment near the embankment-abutment contact and at the right abutment within the emergency spillway channel.		
STAFF GAGE AND RECORDER	None observed.		
DRAINS	Several finger drains observed protruding the downstream embankment toe to the left of the outlet conduit.		
APPURTENANT DIKE	27-foot high, 1600-foot long earth dike spans a low area about 2000 feet northwest of the main embankment. Good condition. Grass covered dike crest and downstream face. Well graded sandstone riprap protects the upstream dike face. The dike is basically cured in plan. No evidence of seepage through the downstream face, sloughing, erosion or excess vegetation was observed. The area along the downstream dike toe is saturated. No measurable flow observed.		

OUTLET WORKS

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS	NDI# PA - 01142
INTAKE STRUCTURE	Submerged, not observed. Intake is located along the upstream face of the service spillway riser about 10 feet above the base of the riser.	
OUTLET CONDUIT (CRACKING AND SPALLING OF CONCRETE SURFACES)	36-inch diameter reinforced concrete pressure pipe discharges at the downstream embankment toe. Service spillway was discharging on the day of the inspection. Consequently, the outlet conduit could not be observed by the field team.	
OUTLET STRUCTURE	Standard SCS-type concrete impact basin in good condition. No significant deterioration observed.	
OUTLET CHANNEL	Rock lined trapezoidal shaped channel merges with natural stream about 500 feet downstream of the impact basin.	
GATE(S) AND OPERATIONAL EQUIPMENT	48-inch by 48-inch water control gate located on the upstream face of the service spillway riser and manually operated from atop the riser. Not operated in the presence of the inspection team.	
LOW FLOW OUTLET	Six inch diameter inlet situated along the downstream face of the service spillway riser about 18 feet above the base of the riser. Controlled via six inch diameter gate valve, manually operated from atop the riser. Not operated in the presence of the inspection team.	

EMERGENCY SPILLWAY

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS	NDW PA.	01142
TYPE AND CONDITION	126-foot wide, trapezoidal shaped channel cut through rock at the right abutment. Good condition. Small concrete curb defines the channel crest.		
APPROACH CHANNEL	100-foot portion of the rock cut channel upstream of the spillway crest.		
SPILLWAY CHANNEL AND SIDEWALLS	Rock cut channel presently grass covered. Substantial abutment seepage (= 50 gpm) evident within the channel. Seepage emanates from different points along the channel, some less than 10 feet below the elevation of the emergency spillway crest.		
STILLING BASIN PLUNGE POOL	None.		
DISCHARGE CHANNEL	Discharges into a trapezoidal shaped, rock lined channel that quickly merges with the natural stream channel downstream.		
BRIDGE AND PIERS EMERGENCY GATES	None.		

SERVICE SPILLWAY

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS	NDIN PA - 01142
TYPE AND CONDITION	Standard SCS-type, concrete riser design. Good condition. No significant deterioration observed.	
APPROACH CHANNEL	N/A.	
OUTLET STRUCTURE	Standard SCS-type, concrete impact basin. Good condition.	
DISCHARGE CHANNEL	See "Outlet Channel", page 4 of 8.	

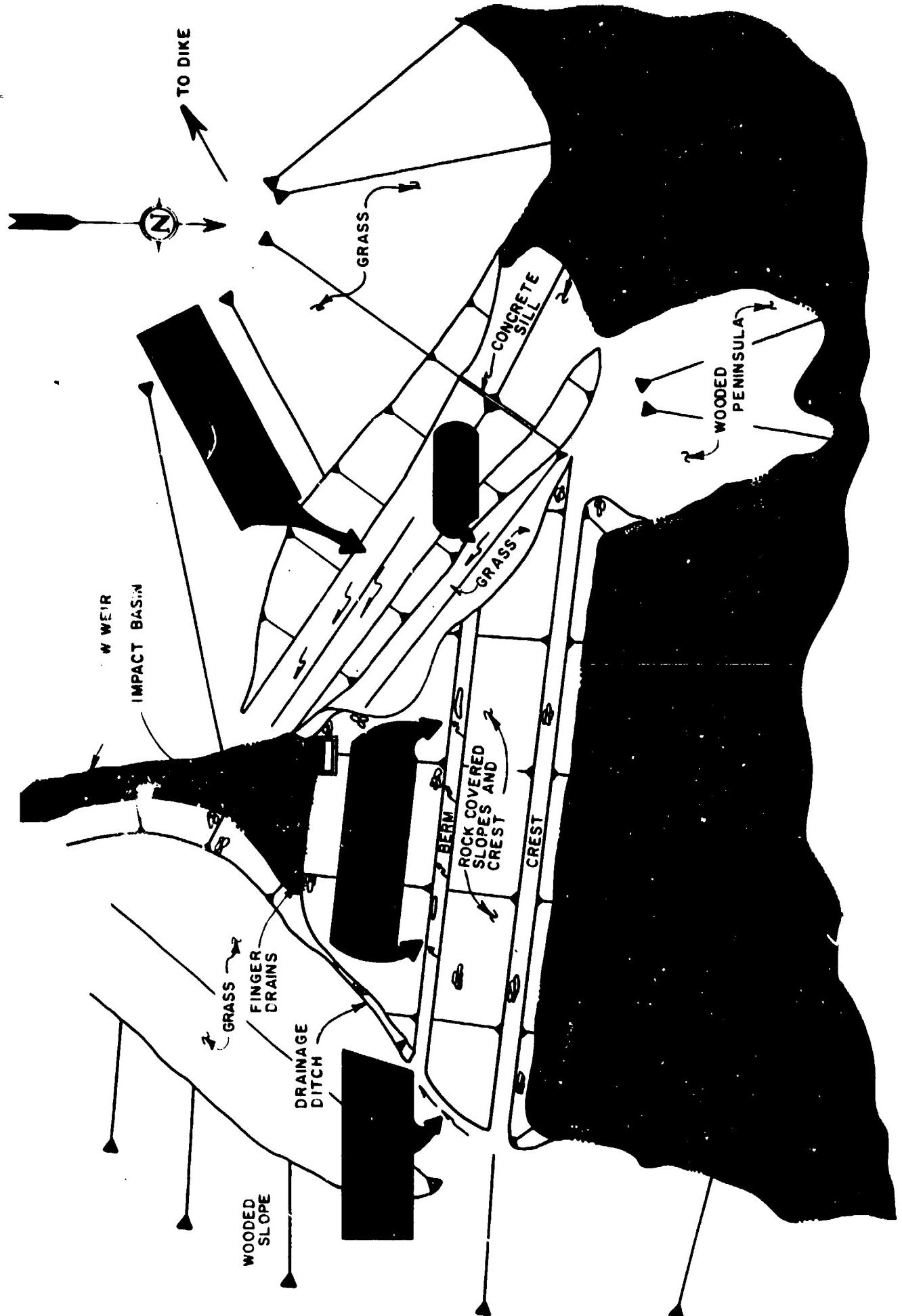
INSTRUMENTATION

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS	NDI# PA - 01142
MONUMENTATION SURVEYS	Three concrete survey monuments, used to monitor settlement across the embankment crest, were observed by the inspection team.	
OBSERVATION WELLS	None.	
WEIRS	Low flow weir situated across stream about 200 feet downstream of dam.	
PIEZOMETERS	Nine piezometers installed in the dam. Post construction monitoring data available from D'Appolonia Consulting Engineers, Inc. of Pittsburgh, Pennsylvania.	
OTHERS		

RESERVOIR AREA AND DOWNSTREAM CHANNEL

ITEM	OBSERVATIONS/REMARKS/RECOMMENDATIONS	NON PA - 01142
SLOPES: RESERVOIR	Moderate to steep and heavily forested slopes.	
SEDIMENTATION	None observed.	
DOWNTREAM CHANNEL (OBSTRUCTIONS, DEBRIS, ETC.)	Stream passes through three small roadway culverts at Gibbon Glade.	
SLOPES: CHANNEL VALLEY	The channels downstream of both the dam and dike are characterized as steep and set in narrow valleys with steep and heavily forested confining slopes. The two streams converge less than 2.2 miles downstream of the dam.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	Gibbon Glade, Pennsylvania located about 3.8 miles downstream of Dam. As many as 17 separate structures, including homes and small businesses, could be affected by an embankment breach. It is estimated that approximately 50 lives could be affected by such an event.	
		PAGE 8 OF 8

HERITAGE RESERVATION DAM
GENERAL PLAN - FIELD INSPECTION NOTES



K-E 10 X 10 TO 1/2 INCH 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 1323

HERITAGE RESERVATION

PROTÉINE D'UN CRISTAL

卷之三

卷之三

卷之三

卷之三

卷之三

卷之三

THE BEGGERMAN

CHAD 81/223 DATE 23/8/81 PROJECT NO 30-232-142

LJ 39(2) • NINETY-NINE

卷之三

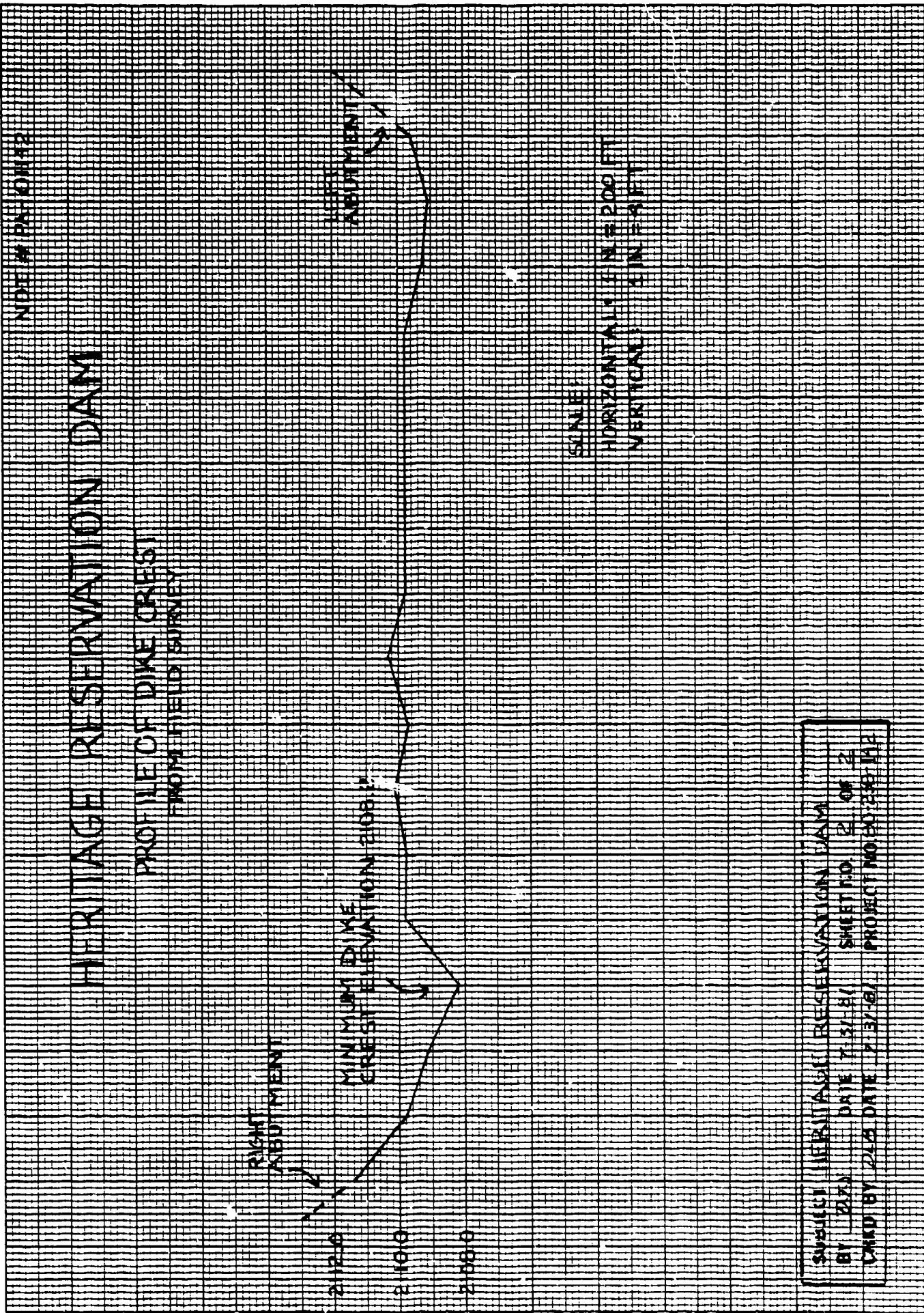
卷之三

LAURENTIA 165

THE UNIVERSITY OF TORONTO LIBRARIES
UNIVERSITY LIBRARY

K-E 10 X 10 TO $\frac{1}{2}$ INCH 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 1323



APPENDIX B
ENGINEERING DATA CHECKLIST

CHECK LIST
ENGINEERING DATA
PHASE I

NAME OF DAM	Heritage Reservation Dam	ITEM	REMARKS	NDI PA.
PERSONS INTERVIEWED AND TITLE	Allegheny Trails Council, Boy Scouts of America. Karl H. Lerz, Director of Properties and Development, Heritage Reservation.			C1142
REGIONAL VICINITY MAP	See Figure 1, Appendix E.			
CONSTRUCTION HISTORY	Designed by D'Appolonia Consulting Engineers, Inc. of Pittsburgh, Pennsylvania. Construction history is contained in "As-Built Report" and "Construction Photographs". Facility was completed in November, 1979. Reports are available from the owner, engineer and PennDER.			
AVAILABLE DRAWINGS	Approximately 65 drawings are available in "As-Built Report".			
TYPICAL DAM SECTIONS	See Figures 5, 7 and 8, Appendix E.			
OUTLETS: PLAN DETAILS DISCHARGE RATINGS	See Figures 8, 9, Appendix E. Discharge rating curves are available; see Appendix D, Sheets 3, 4.			

CHECK LIST
ENGINEERING DATA
PHASE I
(CONTINUED)

ITEM	REMARKS	NDIN PA - 01142
SPILLWAY: PLAN SECTION DETAILS	Service and Emergency: See Figures 1, 6, 8, 9, Appendix E.	
OPERATING EQUIP. MENT PLANS AND DETAILS	See Figure 9, Appendix E.	
DESIGN REPORTS	"Design Report", "Addendum Design Report", and "Hydrology and Hydraulic Calculation Brief" as prepared by D'Appolonio Consulting Engineers, Inc., are available from owner, engineer, and PennDER.	
GEOLOGY REPORTS	Contained in "Design Report".	
DESIGN COMPUTATIONS: HYDROLOGY AND HYDRAULICS STABILITY ANALYSES SEEPAGE ANALYSES	Contained in "Design Report", "Addendum Design Report", and "Hydrology and Hydraulic Calculation Brief".	
MATERIAL INVESTIGATIONS: BORING RECORDS LABORATORY TESTING FIELD TESTING	Contained in "Design Report" and "As-Built Report".	PAGE 2 OF 5

**CHECK LIST
ENGINEERING DATA
PHASE I
(CONTINUED)**

ITEM	REMARKS	NDI/PA - 01142
BORROW SOURCES	Emergency spillway channel and various areas in and around the reservoir. See Sheet 3 of 65, "As-Built Report" (not included in Appendix E).	
POST CONSTRUCTION DAM SURVEYS	"As-Built" report available. Settlement monuments are located along the embankment crest. Post construction settlement data is available from D'Appolonia.	
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None.	No formal records available. Emergency spillway has reportedly not discharged to date.
HIGH POOL RECORDS		
MONITORING SYSTEMS		Piezometers and settlement monuments are monitored at present by D'Appolonia. The most recent available readings were taken in October, 1980.
MODIFICATIONS		None since completion.

CHECK LIST
ENGINEERING DATA
PHASE I
(CONTINUED)

ITEM	REMARKS	NDI# PA - 01142
PRIOR ACCIDENTS OR FAILURES	None.	
Maintenance: Records Manual	No formal maintenance manual is available.	
Operation: Records Manual	No formal operations manual is available; however, a brief "Schedule of Operations" is contained in the "Design Report".	
Operational Procedures	Self-regulating. Procedures for establishing normal winter pool approximately 10 feet below normal summer pool are outlined in the "Schedule of Operations".	
Warning System and/or Communication Facilities	"Emergency Warning System and Evacuation Plan" dated November 1, 1979 is available from both the PennDER and the owner. See Figure 10, Appendix E.	
Miscellaneous		

GAI CONSULTANTS, INC.

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

NDI ID # PA-01142
PENNDER ID # 26-101

SIZE OF DRAINAGE AREA: 5.8 square miles.

ELEVATION TOP NORMAL POOL: 2096.0 STORAGE CAPACITY: 5300 acre-feet.

ELEVATION TOP FLOOD CONTROL POOL: - STORAGE CAPACITY: -

ELEVATION MAXIMUM DESIGN POOL: - STORAGE CAPACITY: -

ELEVATION TOP DAM: 2108.0 STORAGE CAPACITY: 8800 acre-feet.

SPILLWAY DATA

CREST ELEVATION: 2096.0 (service); 2098.0 (emergency).

TYPE: SCS-type riser (service); rock-cut trapezoidal channel (emergency).

CREST LENGTH: Orifice opening (service); 126 feet (emergency).

CHANNEL LENGTH: N/A (service); 430 feet (emergency; crest to downstream toe)

SPILLOVER LOCATION: Near embankment center (service); right abutment(emergency)

NUMBER AND TYPE OF GATES: None.

OUTLET WORKS

TYPE: 36-inch diameter reinforced concrete outlet conduit.

LOCATION: Base of riser structure.

ENTRANCE INVERTS: 2058.0 feet.

EXIT INVERTS: 2044.0 feet.

EMERGENCY DRAWDOWN FACILITIES: 4-foot by 4-foot slide gate that controls flow through a 3-foot by 4-foot opening on the upstream face of the riser tower.

HYDROMETEOROLOGICAL GAGES

TYPE: None.

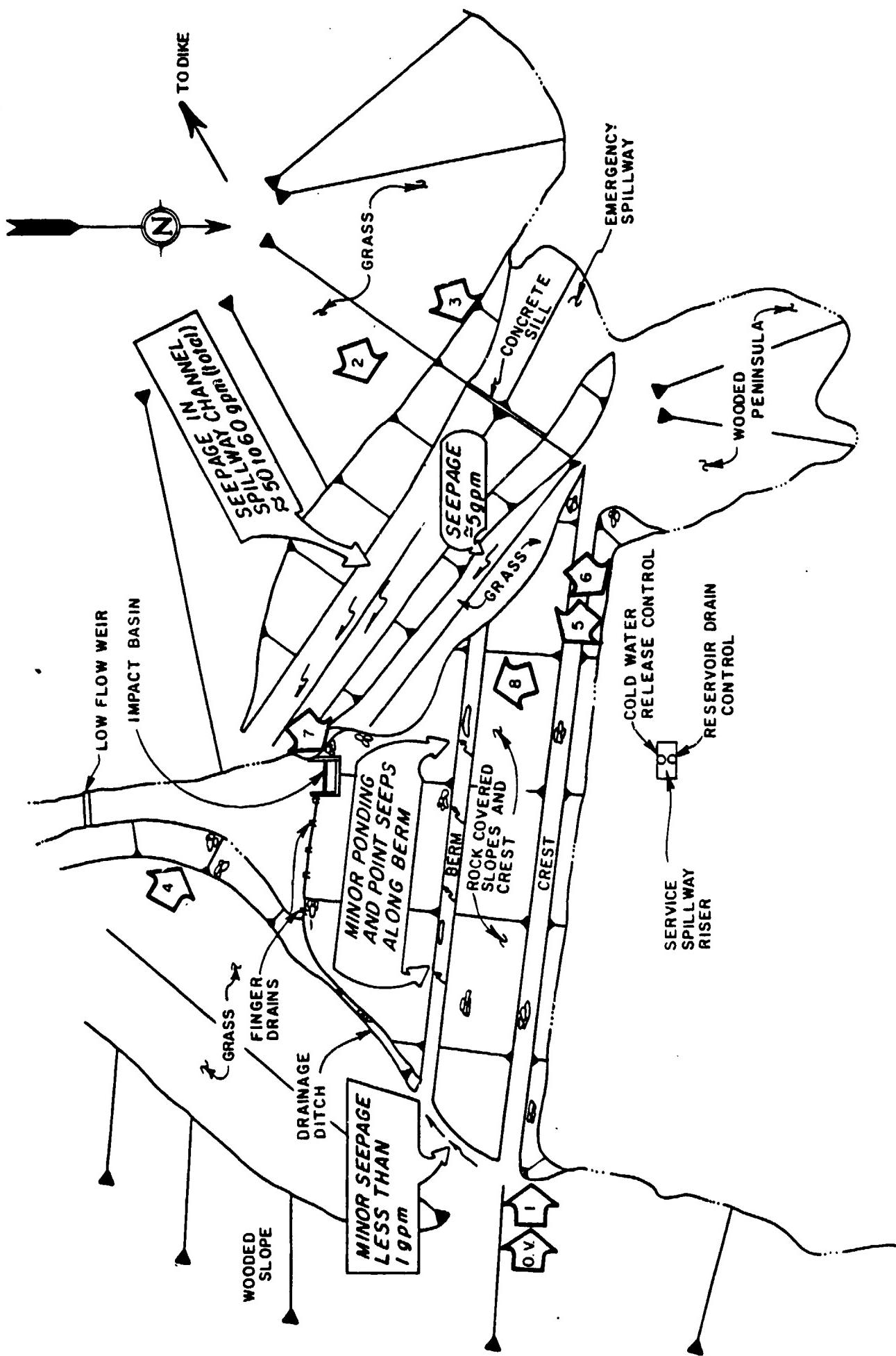
LOCATION: -

RECORDS: -

MAXIMUM NON-DAMAGING DISCHARGE: Emergency spillway has reportedly not discharged to date.

APPENDIX C
PHOTOGRAPHS

**HERITAGE RESERVATION DAM
PHOTOGRAPH KEY MAP**

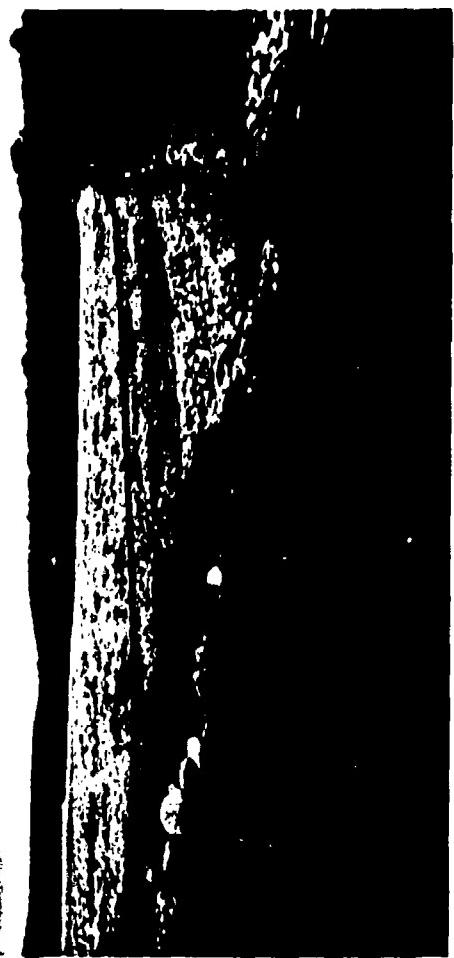


PHOTOGRAPH 1 Overview of Heritage Reservation Dam as seen from the left abutment.

PHOTOGRAPH 2 View of the downstream dam face looking toward the left abutment.

PHOTOGRAPH 3 View of the emergency spillway crest looking downstream from atop the right spillway sidewall.

PHOTOGRAPH 4 View, looking upstream, of the emergency spillway channel and service spillway impact structure.



2



4



1



3

PHOTOGRAPH 5 View of ponding observed along the berm situated on the downstream dam face.

PHOTOGRAPH 6 View of the exposed top portion of the service spillway riser looking upstream from atop the dam crest.

PHOTOGRAPH 7 Close-up view of the service spillway impact basin situated at the downstream dam toe.

PHOTOGRAPH 8 View of the general area immediately downstream of the dam as seen from the dam crest.



6



8



5



7

PHOTOGRAPH 9 View of the crest and downstream face of the dike located about 2,000 feet northwest of the dam.

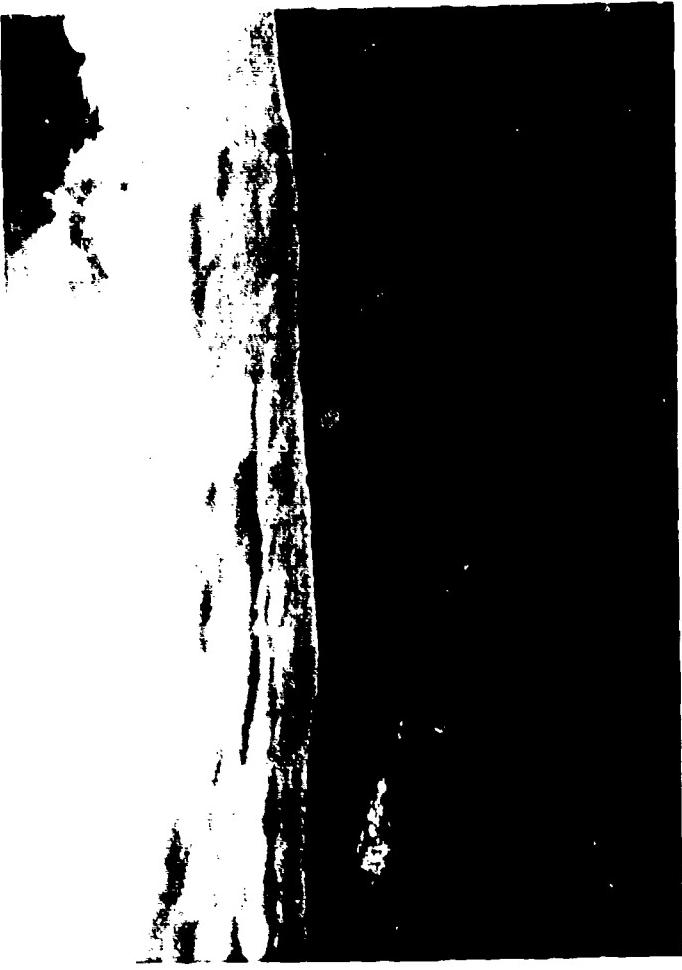
PHOTOGRAPH 10 View of the riprap lined upstream dike face looking toward its left abutment.

PHOTOGRAPH 11 View of minor ponding observed along the downstream dike toe.

PHOTOGRAPH 12 General view of the reservoir impounded by Heritage Reservation Dam as seen from an area situated between the dam and dike.



10



12



9



11

APPENDIX D
HYDROLOGIC AND HYDRAULIC ANALYSES

SUBJECT

DAM SAFETY INSPECTIONHERITAGE RESERVATION DAMBY DJSDATE 7-21-81PROJ. NO. 80-278-142CHKD. BY DJSDATE 7-29-81SHEET NO. 1 OF 8

CONSULTANTS, INC.

Engineers • Geologists • Planners
Environmental SpecialistsDAM STATISTICS

HEIGHT OF DAM = 66 FT (FIELD MEASURED: BASE OF IMPACT BASIN TO TOP OF DAM; "TOP OF DAM" HERE AND ON ALL SUBSEQUENT CALCULATION SHEETS REFERS TO THE MINIMUM ELEVATION ALONG THE EMBANKMENT CREST.)

HEIGHT OF DIKE = 27 FT (FIELD MEASURED: DOWNSTREAM TOE OF DIKE TO MINIMUM EMBANKMENT CREST ELEVATION.)

DRAINAGE AREA = 5.8 SQUARE MILES(PLUMMETED ON USGS topo QUADS -
FOOT MEADOW, PA; OXNAPLE, PA;
BRANDONVILLE, W.VA - PA; AND
FRIENDSVILLE, MD - PA - W.VA.)ELEVATIONS:

Top of Dam (DESIGN)	= 2108.0	(FIG. 5)
Top of Dam (FIELD)	= 2108.0	
Top of Dike (DESIGN)	= 2108.0	(FIG. 7)
Top of Dike (FIELD)	= 2108.2	
EMERGENCY SPILLWAY CREST	= 2098.0	(FIG. 3)
SERVICE SPILLWAY CREST	= 2096.0	(FIG. 8)
NORMAL (SUMMER) POOL	= 2096.0	(FIG. 5)
WINTER POOL (DESIGN)	= 2086.0	(FIG. 5)
INVERT OF RESERVOIR DRAIN CONTROL GATE (DESIGN)	= 2058.0	(FIG. 8)
RESERVOIR DRAIN & SERVICE SPILLWAY OUTLET INVERT	= 2044.0	(FIG. 8, + ²⁵⁴⁰ ft. ₁₅₀₀)
BASE OF IMPACT BASIN	= 2041.7	(FIG. 8)
STREAMBED @ DAM CENTERLINE	= 2043	(EST., FIG. 3)
DOWNSTREAM TOE OF DIKE	= 2080.8	(FIELD)

STORAGE CAPACITY @ NORMAL POOL = 5300 AC-FT

(SHEET 3)

STORAGE CAPACITY @ TOP of Dam = 8800 AC-FT

(SHEET 3)

SUBJECT DAM SAFETY INSPECTION
HERITAGE RESERVATION DAM
BY DJS DATE 7-21-81 PROJ. NO. 80-238-142
CHKD. BY DLO DATE 7-29-81 SHEET NO. 2 OF 8



DAM CLASSIFICATION

DAM SIZE: INTERMEDIATE (REF 1, TABLE 1)
HAZARD CLASSIFICATION: HIGH (FIELD OBSERVATION)
REQUIRED SDF: PMF (REF. 1, TABLE 3)

DESIGN DATA

THE SERVICE AND EMERGENCY SPILLWAYS WERE DESIGNED SUCH THAT THE 100-YEAR FLOOD WOULD PASS WITHOUT DISCHARGING THROUGH THE EMERGENCY SPILLWAY, AND SUCH THAT THE PMF WOULD PASS WITHOUT OVERTOPPING THE DAM AND THE APPURTENANT DIKE. THE PMF INFLOW AND OUTFLOW HYDROGRAPHS WERE DEVELOPED BY USING THE MODIFIED HEC-1 PROGRAM, WITH EMPLOYMENT OF THE SCS DIMENSIONLESS UNIT HYDROGRAPH OPTION, AND WITH THE USE OF THE SCS LOSS RATE PROCEDURE (CURVE NUMBER METHOD).

THE PEAK INFLOW UNDER PMF CONDITIONS WAS APPROXIMATELY 25,160 CFS. THE RESULTING PEAK OUTFLOW WAS ABOUT 10,610 CFS, CORRESPONDING TO A MAXIMUM RESERVOIR ELEVATION OF 2107.9 FT. SINCE THE TOP OF DAM ELEVATION WAS FIELD MEASURED TO BE 2108.0 FT, IT IS CONCLUDED THAT THE SPILLWAY SYSTEM AT HERITAGE RESERVATION DAM IS APPROPRIATE (THE EMERGENCY SPILLWAY WAS DETERMINED IN THE FIELD INSPECTION TO MEET DESIGN CONDITIONS).

THE PERTINENT HYDROLOGIC AND HYDRAULIC DESIGN DATA ARE PROVIDED ON THE FOLLOWING PAGES, AS OBTAINED FROM

"DESIGN REPORT"

"AS-BUILT REPORT"

"APPENDIX DESIGN REPORT"

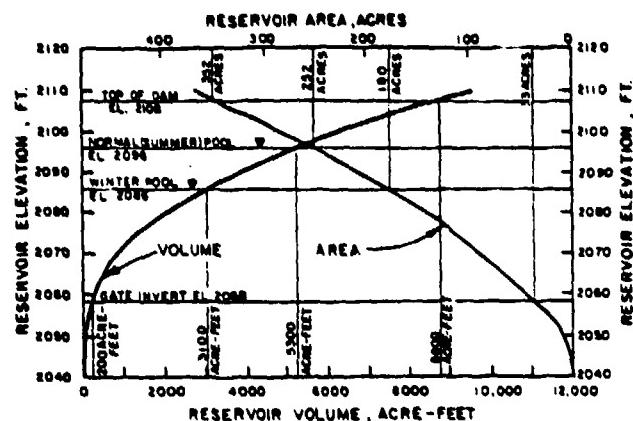
"HYDROLOGY AND HYDRAULIC CALCULATION REPORT"

HERITAGE RESERVATION DAM
D'APPOLONIA CONSULTANTS, INC.
DATED 1979, 1980

SUBJECT DAM SAFETY INSPECTION
HERITAGE RESERVATION DAM
BY DTS DATE 7-21-81 PROJ. NO. 80-238-142
CHKD. BY DLO DATE 7-29-81 SHEET NO. 3 OF 8



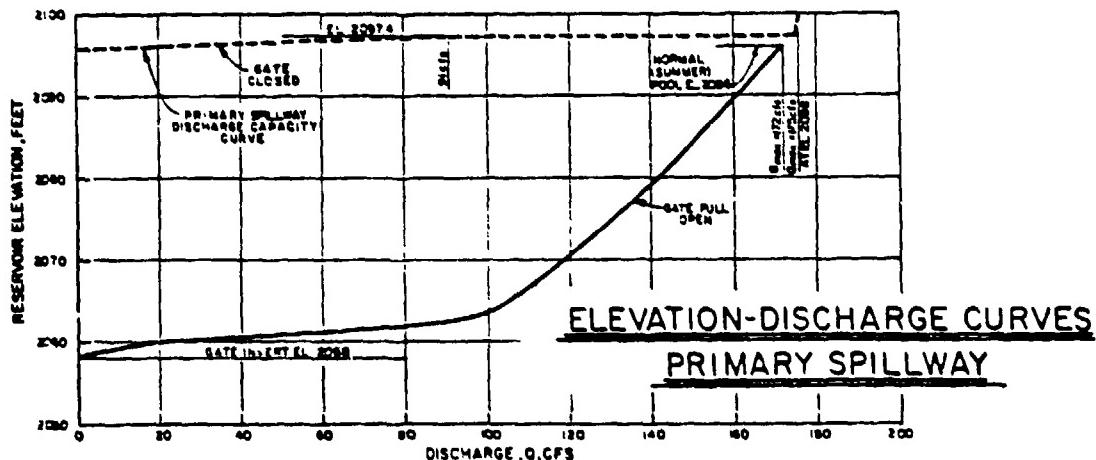
STORAGE CAPACITY:



ELEVATION VS. RESERVOIR AREA
AND RESERVOIR VOLUME

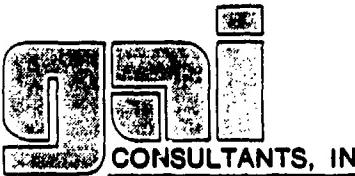
(From "As-Built Report")

CAPACITY OF SERVICE SPILLWAY AND RESERVOIR DRAIN:



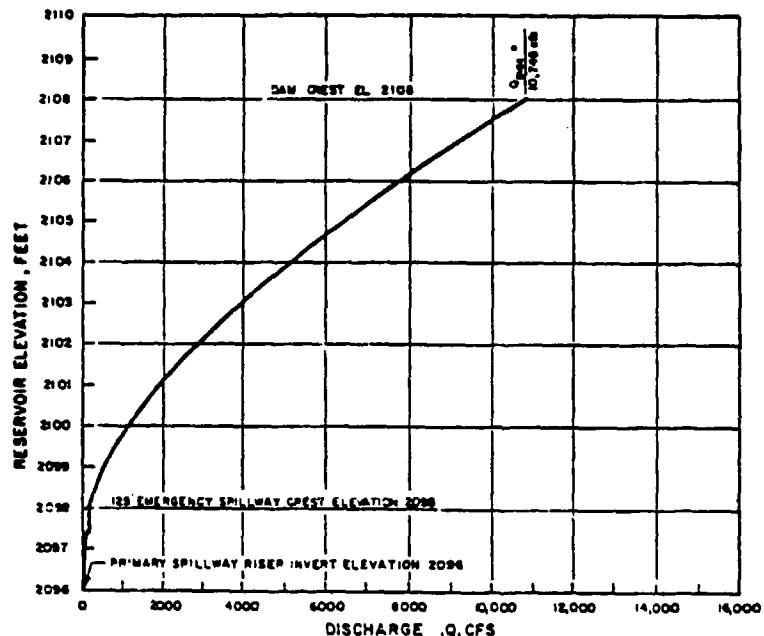
(From "As-Built Report")

SUBJECT DAM SAFETY INSPECTION
HERITAGE RESERVATION DAM
BY ZJZ DATE 7-21-81 PROJ. NO. 80-238-142
CHKD. BY DLB DATE 7-29-81 SHEET NO. 4 OF 8



**Engineers • Geologists • Planners
Environmental Specialists**

CAPACITY OF SERVICE SPILLWAY AND EMERGENCY SPILLWAY:



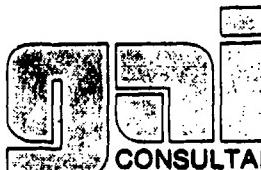
(FROM "AS-BUILT REPORT")

ELEVATION-DISCHARGE CURVE

PRIMARY AND EMERGENCY SPILLWAYS

THE PRIMARY OR SERVICE SPILLWAY CONSISTS OF A STANDARD SCS - TYPE REINFORCED CONCRETE RISER STRUCTURE CONNECTED TO A 36-INCH DIAMETER REINFORCED CONCRETE OUTLET CONDUIT. THE RESERVOIR DRAIN CONSISTS OF A 4 FT X 4 FT SLIDE GATE THAT CONTROLS FLOW THROUGH A 3FT X 4FT OPENING ON THE UPSTREAM FACE OF THE RISER TOWER. THE EMERGENCY SPILLWAY CONSISTS OF A TRAPEZOIDAL CHANNEL CUT IN ROCK AT THE RIGHT ABUTMENT.

SUBJECT DAM SAFETY INSPECTION
HERITAGE RESERVATION DAM
BY DTT DATE 7-21-81 PROJ. NO. 80-238-142
CHKD. BY DLB DATE 7-29-81 SHEET NO. 5 OF 8



CONSULTANTS, INC.

**Engineers • Geologists • Planners
Environmental Specialists**

HEC-1 SUMMARY INPUT/OUTPUT:

1 A1 SNYDER UNIT HYDROGRAPH, DESIGN FLOOD ROUTING ANALYSIS
 2 A2 FOR PMF, 3' PIPE AND RISER AT 2096, 125° BROADCREST EM. SPILLWAY AT 2098
 3 A3 BOY SCOUT OF AMERICA DAM, FORT NECESSITY, FAYETTE COUNTY, PA (78-173-11)
 4 B 300 0 10 0 0 0 0 0 0 0 C
 5 R1 5
 6 J 1 1 1
 7 J1 1.00
 8 K 0 1 1
 9 K1 CALCULATION OF SCS INFLOW HYDROGRAPH TO PROPOSED LITTLE SANDY CREEK DAM
 10 M 1 2 5.81 5.81 1
 11 P 24.2 102 120 130 140
 12 T -1 -65A 0.0818
 13 W2 1.13 ← BASIN LAG
 14 X -1.0 -0.05 2.0
 15 K 1 2 1
 16 K1 ROUTING THROUGH 3' PIPE AND RISER AT EL. 2096, 125° BROADCREST AT EL. 2098
 17 Y 1 1
 18 Y1 1 5337.3 -1
 19 TOTAL { Y42096.0 2097.0 2097.39 2097.4 2098.0 2099.0 2100.0 2101.0 2102.0 2103.0
 20 SPILLWAY { Y42104.0 2105.0 2106.0 2107.0 2108.0 2109.0
 21 RATING { Y5 0.0 55.8 91.2 173.9 175.0 510.4 1122.3 1914.2 2851.6 3914.7
 22 CURVE { Y55090.0 6367.0 7740.0 9200.9 10745.3 12368.9
 23 STORAGE { SS 0.0 12.3 260.3 950.3 2120.3 3861.3 5337.3 6321.3 9593.3
 24 DATA { SE2043.0 2050.0 2060.0 2070.0 2080.0 2090.0 2096.0 2100.0 2110.0
 25 SS2096.0
 26 SS2110.0 3.08 1.5 800.0
 27 K 99

ROUTING DATA:

SUBJECT DAM SAFETY INSPECTION
HERITAGE RESERVATION DAM
BY DTS DATE 7-21-81 PROJ. NO. 80-238-143
CHKD. BY DLC DATE 7-29-81 SHEET NO. 6 OF 8



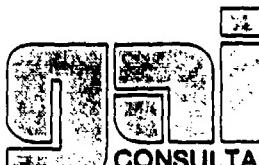
GGR CONSULTANTS, INC.

Engineers • Geologists • Planners
Environmental Specialists

DAM DATA							PMF
TOPEL	CODD	EXPD	DAMWID	STATION 2, PLAN 1, RATIO 1			INFLOW/OUTFLOW DATA
2110.0	3.1	1.5	800.				
END-OF-PERIOD HYDROGRAPH ORDINATES							
NO.DA	HR.MN	PERIOD	HOURS	INFLOW	OUTFLOW	STORAGE	STAGE
1.01	.10		1	.17	5.	0.	5337.
1.01	.20		2	.33	5.	0.	5337.
1.01	.30		3	.50	5.	0.	5338.
1.01	.40		4	.67	6.	0.	5338.
1.01	.50		5	.83	6.	0.	5338.
1.01	1.00		6	1.00	6.	0.	5338.
1.01	1.10		7	1.17	6.	0.	5338.
•	•		•	•	•	•	•
•	•		•	•	•	•	•
•	•		•	•	•	•	•
•	•		•	•	•	•	•
1.02	14.50	235	38.83	8725.	2713.	6927.	2101.9
1.02	15.00	234	39.00	9096.	2966.	7011.	2102.1
1.02	15.10	235	39.17	9374.	3241.	7095.	2102.4
1.02	15.20	236	39.33	9656.	3515.	7180.	2102.6
1.02	15.30	237	39.50	10334.	3799.	7267.	2102.9
1.02	15.40	238	39.67	12690.	4159.	7371.	2103.2
1.02	15.50	239	39.83	16863.	4672.	7514.	2103.6
1.02	16.00	240	40.00	21958.	5408.	7712.	2104.2
1.02	16.10	241	40.17	24996.	6354.	7954.	2105.0
1.02	16.20	242	40.33	25160.	7405.	8205.	2105.8
1.02	16.30	243	40.50	23065.	8381.	8428.	2106.4
1.02	16.40	244	40.67	19959.	9165.	8604.	2107.0
1.02	16.50	245	40.83	16968.	9745.	8727.	2107.4
1.02	17.00	246	41.00	14770.	10128.	9808.	2107.6
1.02	17.10	247	41.17	13319.	10374.	8860.	2107.8
1.02	17.20	248	41.33	12168.	10523.	8892.	2107.9
1.02	17.30	249	41.50	11215.	10597.	8907.	2107.9
1.02	17.40	250	41.67	10382.	10610.	8910.	2107.9
1.02	17.50	251	41.83	9692.	10574.	8903.	2107.9
1.02	18.00	252	42.00	9143.	10501.	8887.	2107.8
1.02	18.10	253	42.17	8634.	10400.	8866.	2107.8
1.02	18.20	254	42.33	7934.	10267.	8838.	2107.7
1.02	18.30	255	42.50	6869.	10087.	8799.	2107.6
1.02	18.40	256	42.67	5595.	9844.	8748.	2107.4
1.02	18.50	257	42.83	4336.	9537.	8683.	2107.2
1.02	19.00	258	43.00	3263.	9177.	8606.	2107.0
1.02	19.10	259	43.17	2450.	8800.	8522.	2106.7
1.02	19.20	260	43.33	1910.	8405.	8433.	2106.5
1.02	19.30	261	43.50	1547.	8006.	8344.	2106.2
1.02	19.40	262	43.67	1289.	7621.	8256.	2105.9
1.02	19.50	263	43.83	1189.	7262.	8171.	2105.7
1.02	20.00	264	44.00	1109.	6919.	8089.	2105.4
1.02	20.10	265	44.17	1035.	6590.	8011.	2105.2
1.02	20.20	266	44.33	965.	6283.	7936.	2104.9
1.02	20.30	267	44.50	901.	6002.	7864.	2104.7
1.02	20.40	268	44.67	840.	5734.	7795.	2104.5
1.02	20.50	269	44.83	784.	5476.	7729.	2104.3
1.02	21.00	271	45.00	732.	5229.	7666.	2104.1
1.02	21.10	271	45.17	720.	5001.	7605.	2103.9
1.02	21.20	272	45.33	712.	4794.	7548.	2103.7
1.02	21.30	273	45.50	707.	4597.	7493.	2103.6

QMAX INFLOW
QMAX OUTFLOW
MAX. POOL LEVEL

SUBJECT DAM SAFETY INSPECTION
HERITAGE RESERVATION DAM
BY DTS DATE 7-21-81 PROJ. NO. 80-238-142
CHKD. BY DLC DATE 7-29-81 SHEET NO. 7 OF 8



CONSULTANTS, INC.

Engineers • Geologists • Planners
Environmental Specialists

SUMMARY OUTPUT:

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

RATIOS APPLIED TO FLOWS

OPERATION	STATION	AREA	PLAN RATIO	1
				1.00
HYDROGRAPH AT	1	5.81	1	25160. ← QMAX IN (15.05) (712.45) (
OUTED TO	2	5.81	1	10610. ← QMAX OUT (15.05) (300.43) (

SUMMARY OF DAM SAFETY ANALYSIS

ELEVATION	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
STORAGE	2096.00	2196.00	2110.00
OUTFLOW	5337.	5337.	9593.

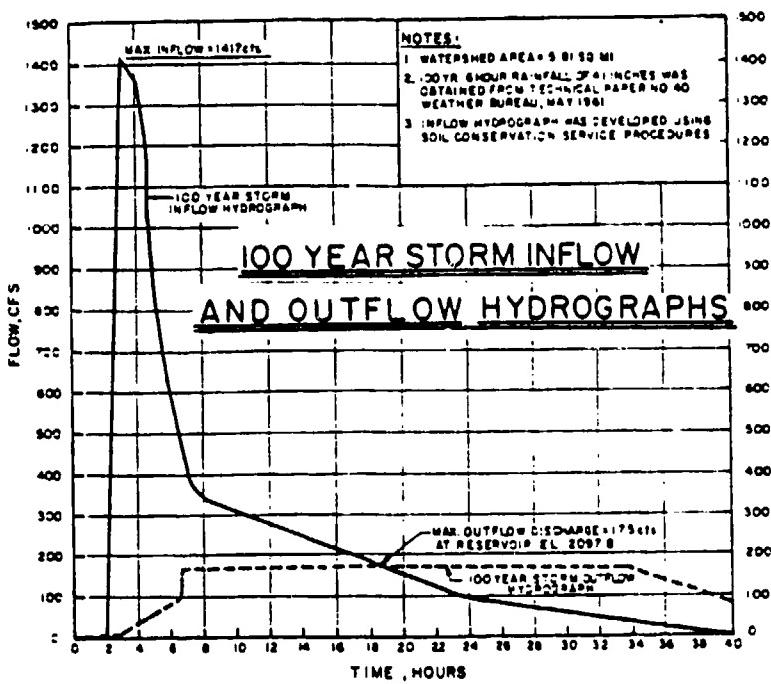
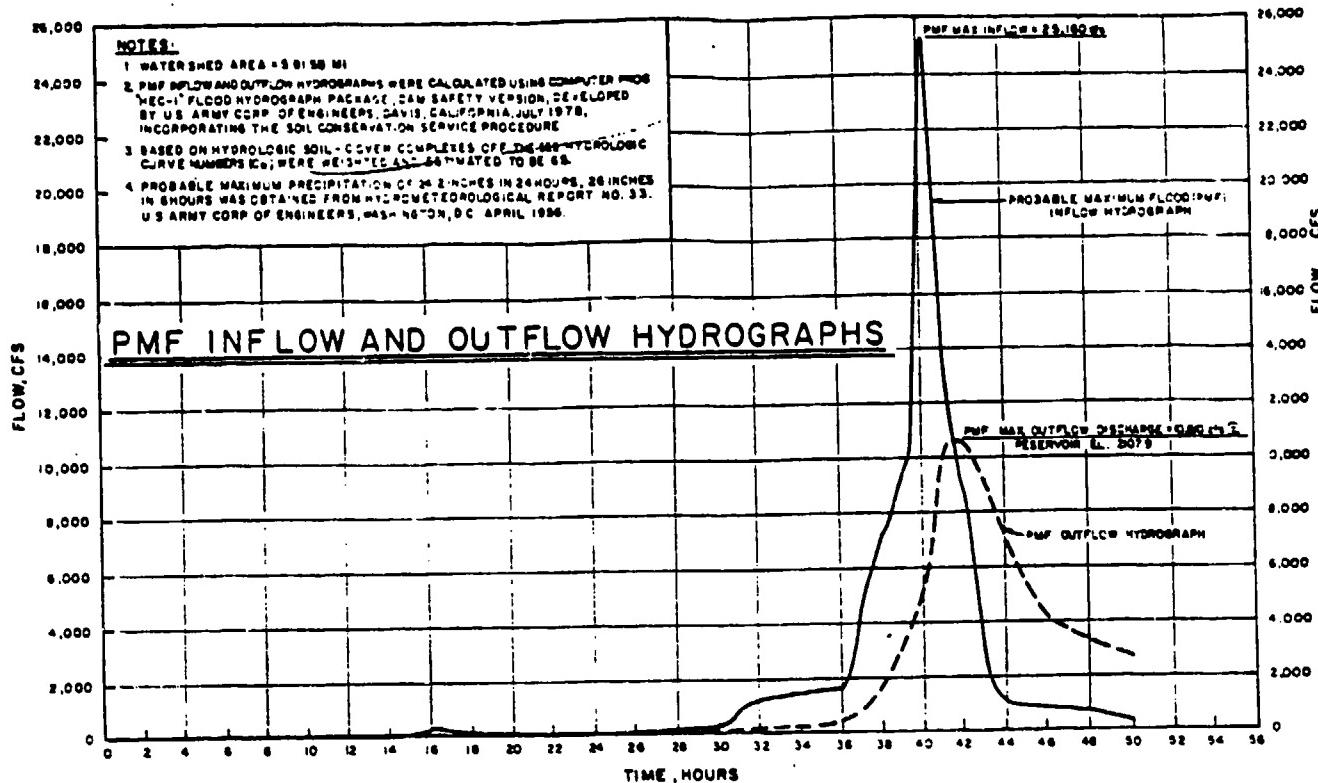
RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	2107.91	0.00	8910.	13610.	0.00	41.67	0.00

(From "Reservoir Design Report")

SUBJECT DAM SAFETY INSPECTION
HERITAGE RESERVATION DAM
BY DJS DATE 7-21-81 PROJ. NO. 80-238-142
CHKD. BY DLB DATE 7-29-81 SHEET NO. 8 OF 8



CONSULTANTS, INC.
Engineers • Geologists • Planners
Environmental Specialists



(From "AS-BUILT
REPORT")

LIST OF REFERENCES

1. "Recommended Guidelines for Safety Inspection of Dams," prepared by Department of the Army, Office of the Chief of Engineers, Washington, D. C. (Appendix D).
2. "Unit Hydrograph Concepts and Calculations," by the U. S. Army, Corps of Engineers, Baltimore District (L-519).
3. "Seasonal Variation of Probable Maximum Precipitation East of the 105th Meridian for Areas from 10 to 1,000 Square Miles and Durations of 6, 12, 24, and 48 Hours," Hydrometeorological Report No. 33, prepared by J. T. Riedel, J. F. Appleby and R. W. Schloemer, Hydrologic Service Division, Hydrometeorological Section, U. S. Army, Corps of Engineers, Washington, D. C., April 1956.
4. Design of Small Dams, U. S. Department of the Interior, Bureau of Reclamation, Washington, D. C., 1973.
5. Handbook of Hydraulics, H. W. King, and E. F. Brater, McGraw-Hill, Inc., New York, 1963.
6. Standard Handbook for Civil Engineers, F. S. Merritt, McGraw-Hill, Inc., New York, 1963.
7. Open-Channel Hydraulics, V. T. Chow, McGraw-Hill, Inc., New York, 1959.
8. Weir Experiments, Coefficients, and Formulas, R. E. Horton, Water Supply and Irrigation Paper No. 200, Department of the Interior, United States Geological Survey, Washington, D. C., 1907.
9. "Probable Maximum Precipitation, Susquehanna River Drainage Above Harrisburg, Pennsylvania," Hydrometerological Report No. 40, prepared by H. V. Goodyear and J. T. Riedel, Hydrometeorological Branch Office of Hydrology, U. S. Weather Bureau, U. S. Department of Commerce, Washington, D. C., May, 1965.
10. Flood Hydrograph Package (HEC- 1) Dam Safety Version, Hydrologic Engineering Center, U. S. Army, Corps of Engineers, Davis, California, July 1978.
11. "Simulation of Flow Through Broad Crest Navigation Dams with Radial Gates," R. W. Schmitt, U. S. Army, Corps of Engineers, Pittsburgh District.
12. "Hydraulics of Bridge Waterways," BPR, 1970, Discharge Coefficient Based on Criteria for Embankment Shaped Weirs, Figure 24, page 46.

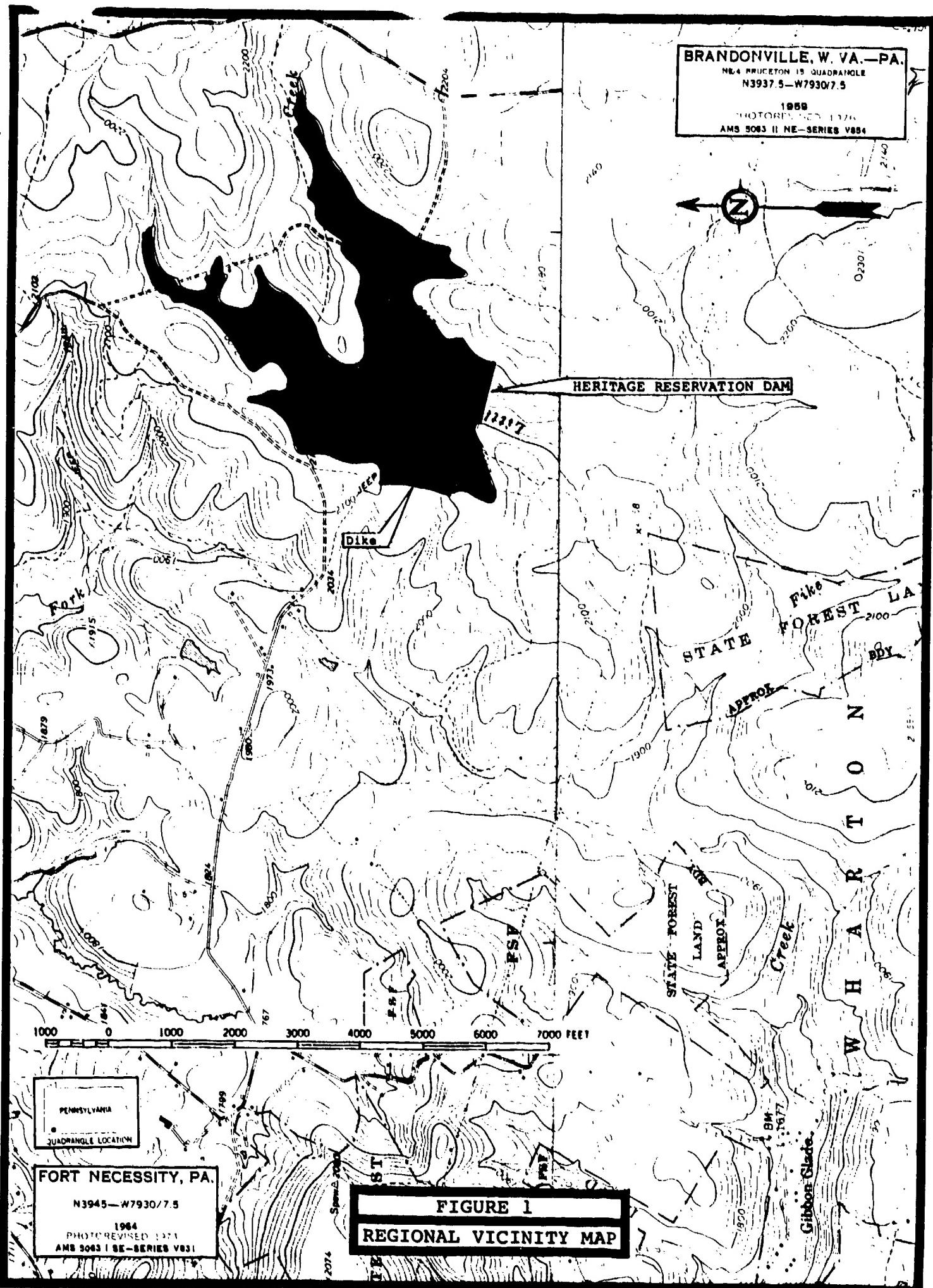
13. Applied Hydraulics in Engineering, H. M. Morris and J. N. Wiggert, Virginia Polytechnic Institute and State University, 2nd Edition, The Ronald Press Company, New York, 1972.
14. Standard Mathematical Tables, 21st Edition, The Chemical Rubber Company, 1973, page 15.
15. Engineering Field Manual, U. S. Department of Agriculture, Soil Conservation Service, 2nd Edition, Washington, D. C., 1969.
16. Water Resources Engineering, R. K. Linsley and J. B. Franzini, McGraw-Hill, Inc., New York, 1972.
17. Engineering for Dams, Volume 2, W. P. Creager, J. D. Justin, J. Hinds, John Wiley & Sons, Inc., New York, 1964.
18. Roughness Characteristics of Natural Channels, H. H. Barnes, Jr., Geological Survey Water-Supply Paper 1849, Department of the Interior, United States Geological Survey, Arlington, Virginia, 1967.
19. "Hydraulic Charts for the Selection of Highway Culverts," Hydraulic Engineering Circular No. 5, Bureau of Public Roads, Washington, D. C., 1965.

APPENDIX E

FIGURES

LIST OF FIGURES

<u>Figure</u>	<u>Description/Title</u>
1	Regional Vicinity Map
2	Watershed Boundary Map
3	Plan of Dam and Emergency Spillway
4	Plan of Dike
5	Dam Profile and Cross Section
6	Profile of Emergency Spillway
7	Dike Profile and Cross Section
8	Service Spillway Plan and Profile
9	Service Spillway Riser Plan and Arrangement
10	Plan of Emergency Evacuation Measures



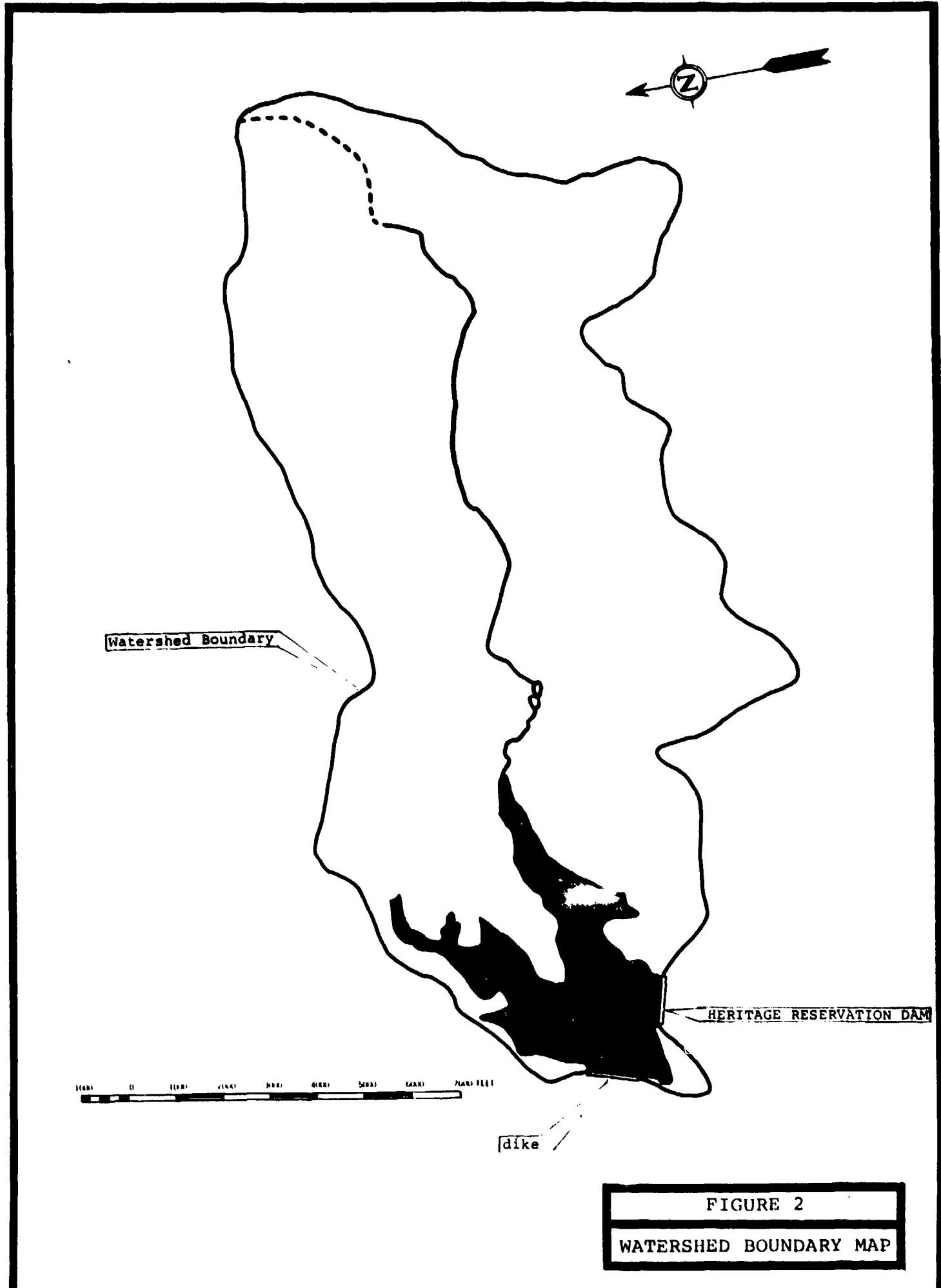
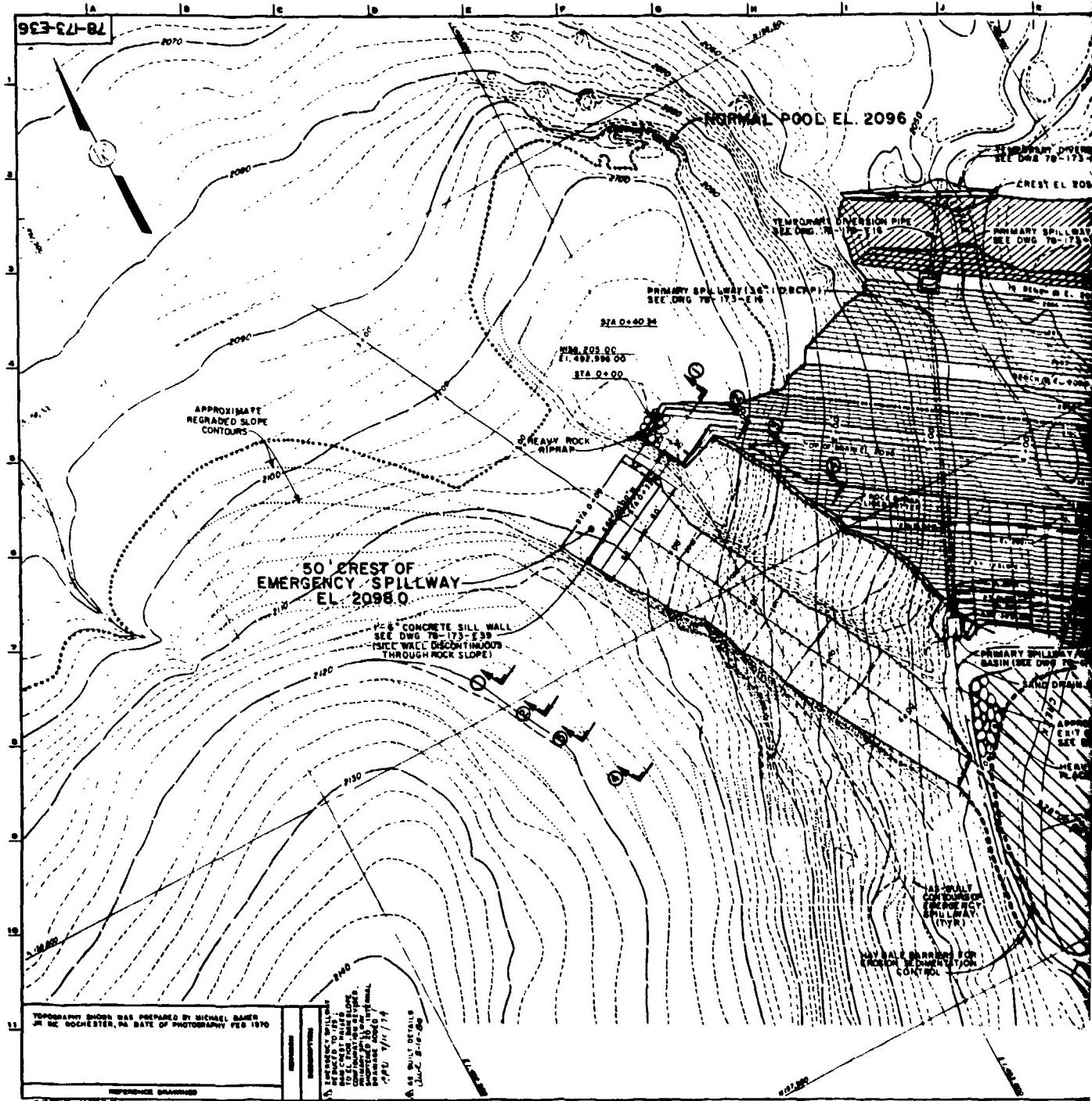
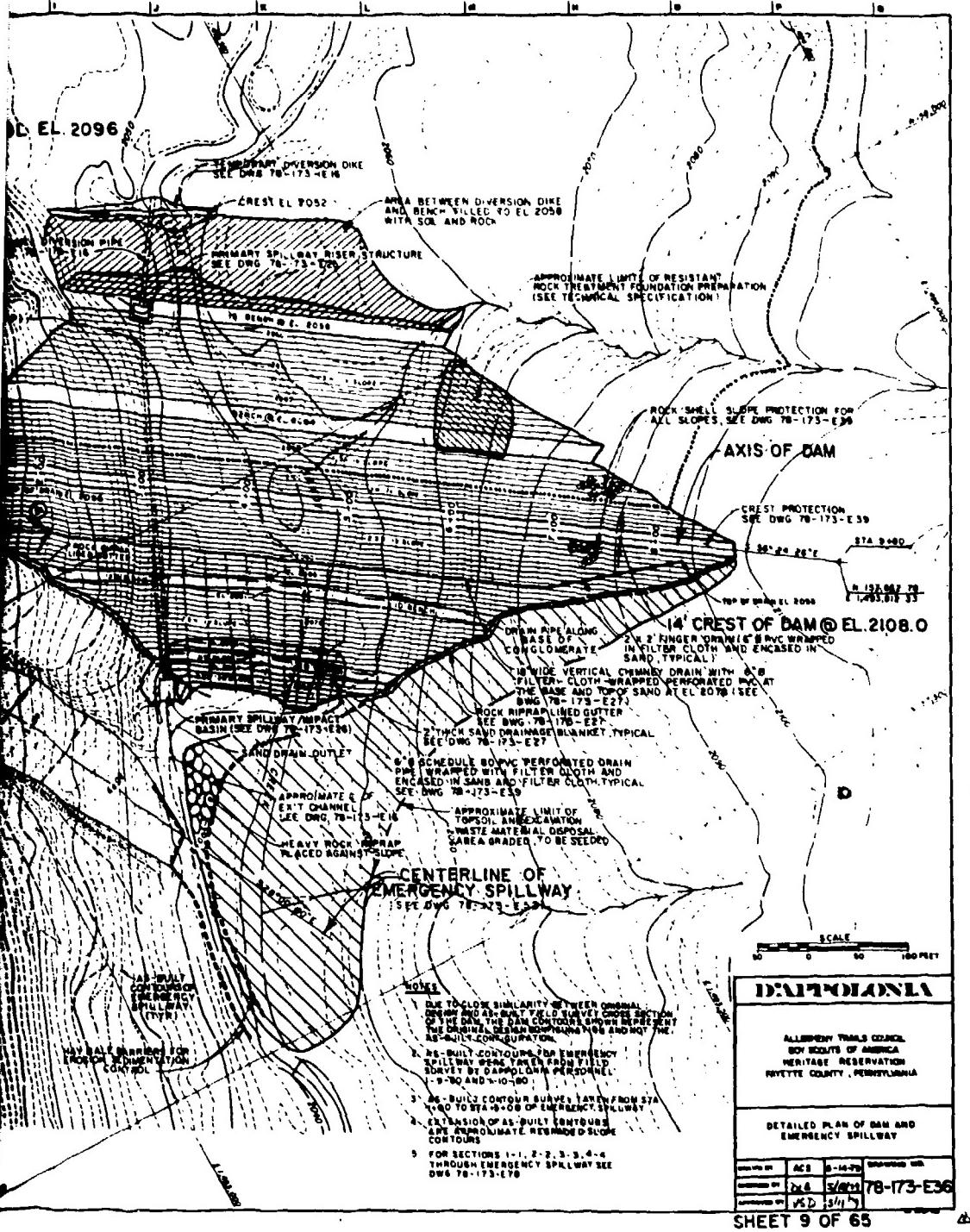


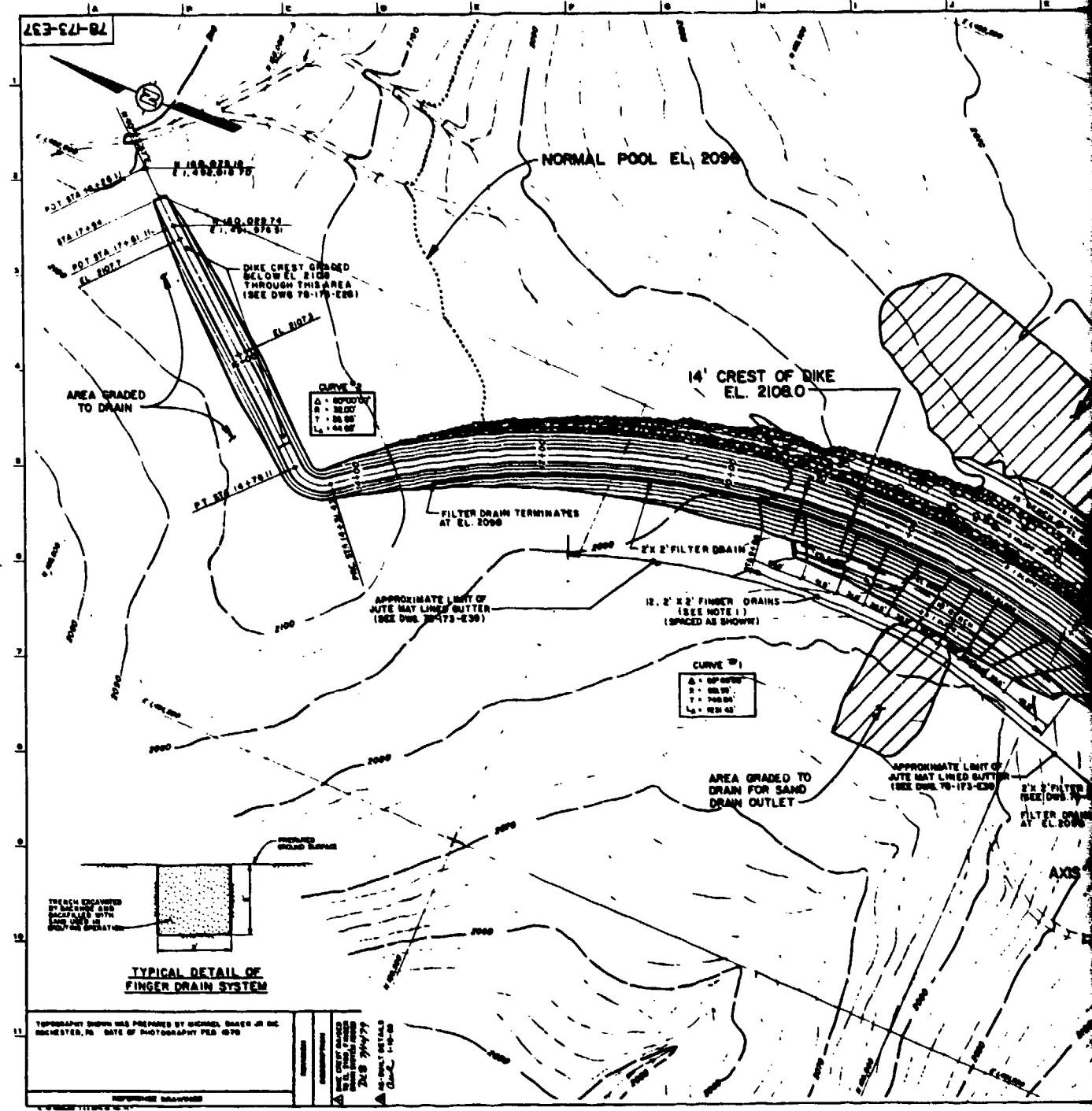
FIGURE 2
WATERSHED BOUNDARY MAP





GAI
CONSULTANTS, INC.

FIGURE 3



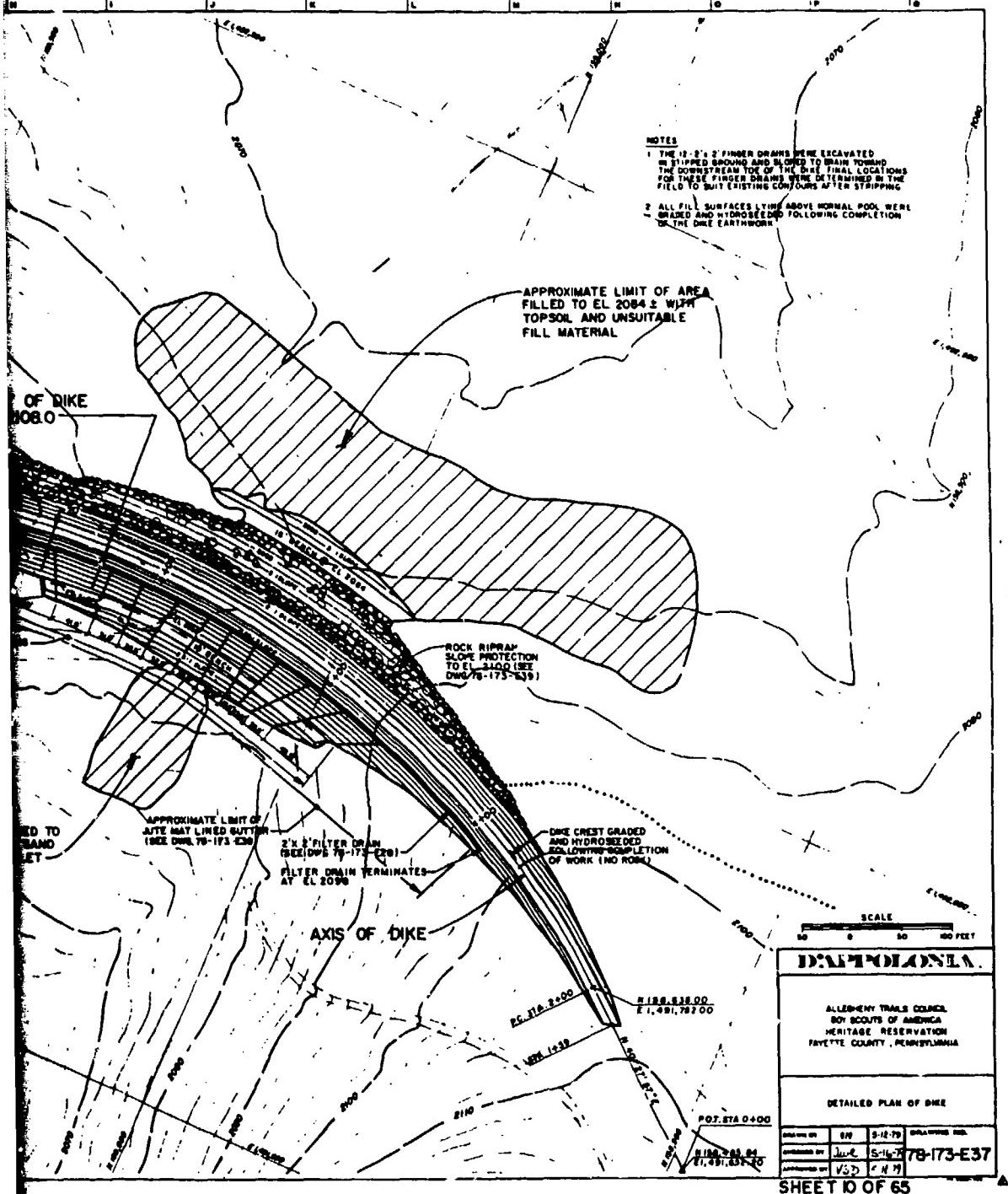
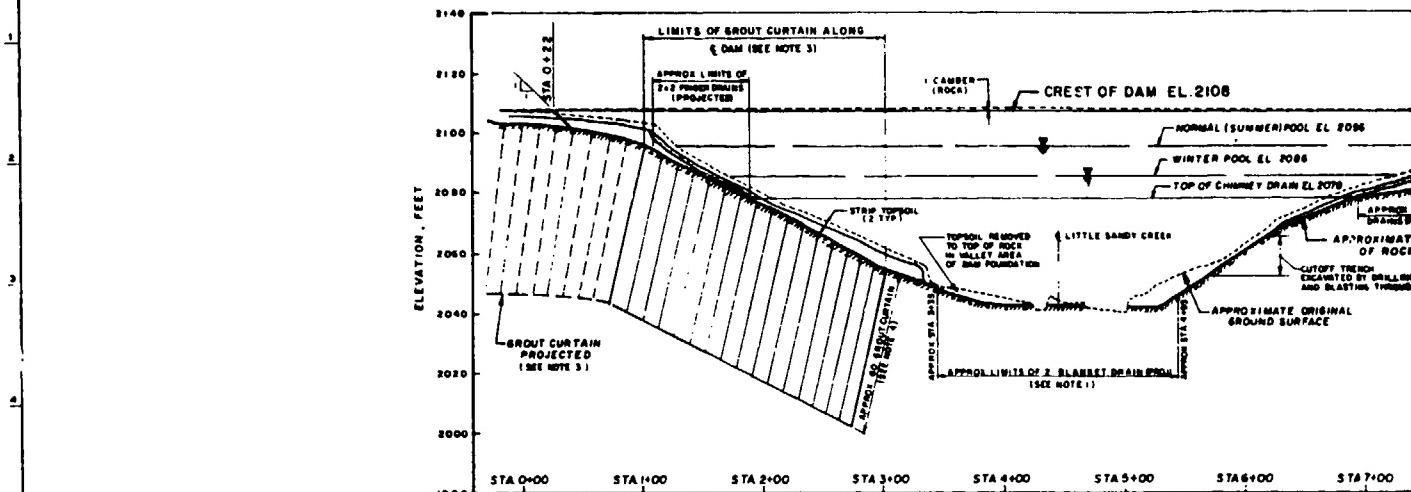


FIGURE 4

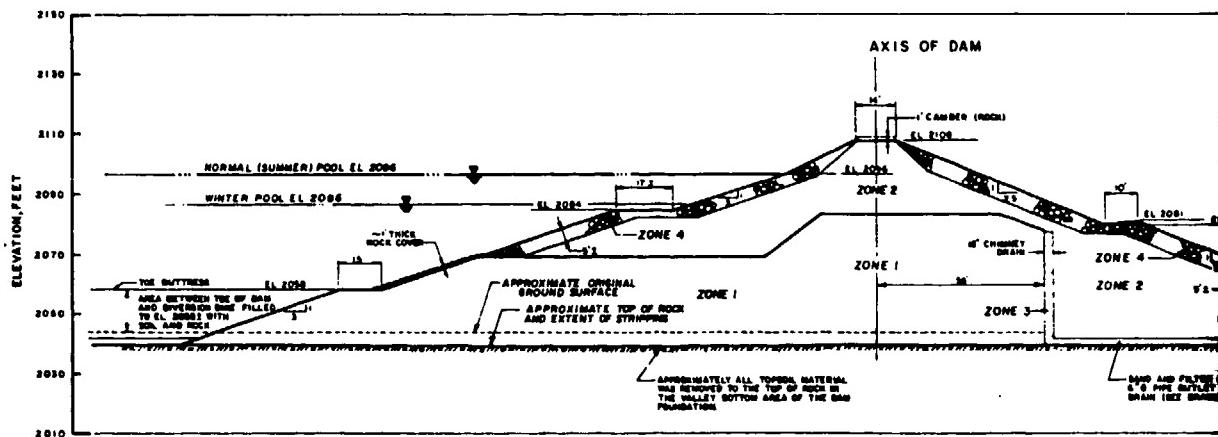
78-173-E27



PROFILE AT CENTERLINE OF DAM

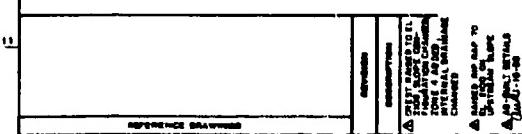
VERTICAL SCALE **HORIZONTAL SCALE**

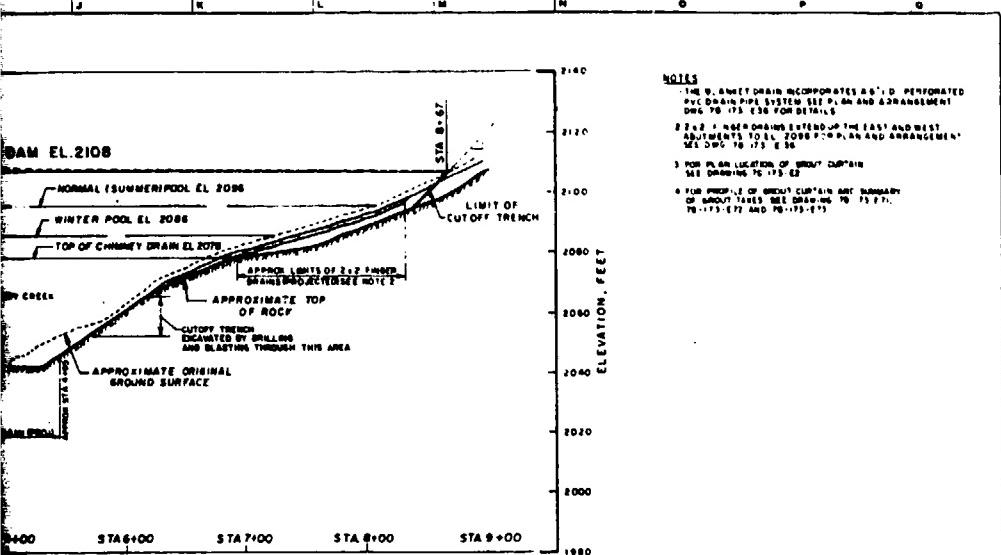
The image shows two scale bars. The vertical scale bar is at the bottom left, labeled "VERTICAL SCALE" above it. It has markings at 20, 0, 20, and 40 FEET. The horizontal scale bar is at the bottom right, labeled "HORIZONTAL SCALE" above it. It has markings at 80, 0, 80, and 100 FEET.



TYPICAL SECTION THROUGH DAM

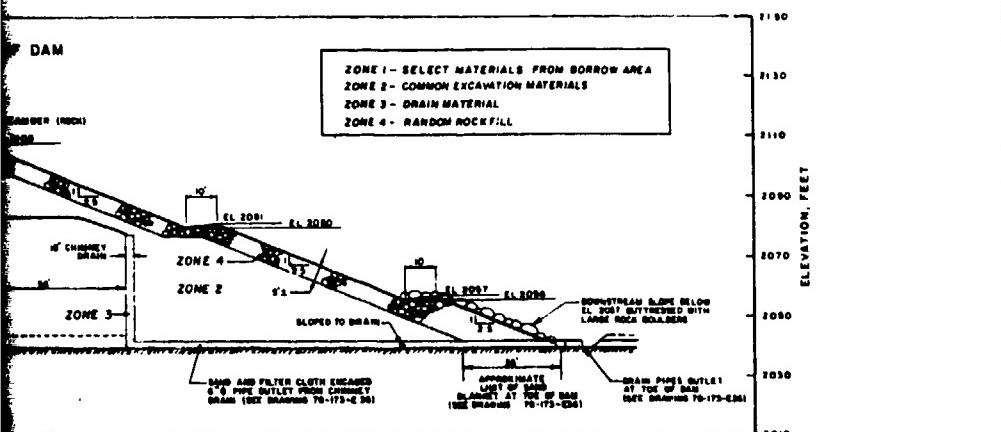
SCALE
20 0 20 40 FEET





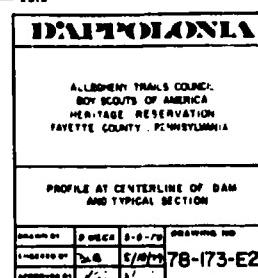
LINE OF DAM

HORIZONTAL SCALE



THROUGH DAM

E FORM

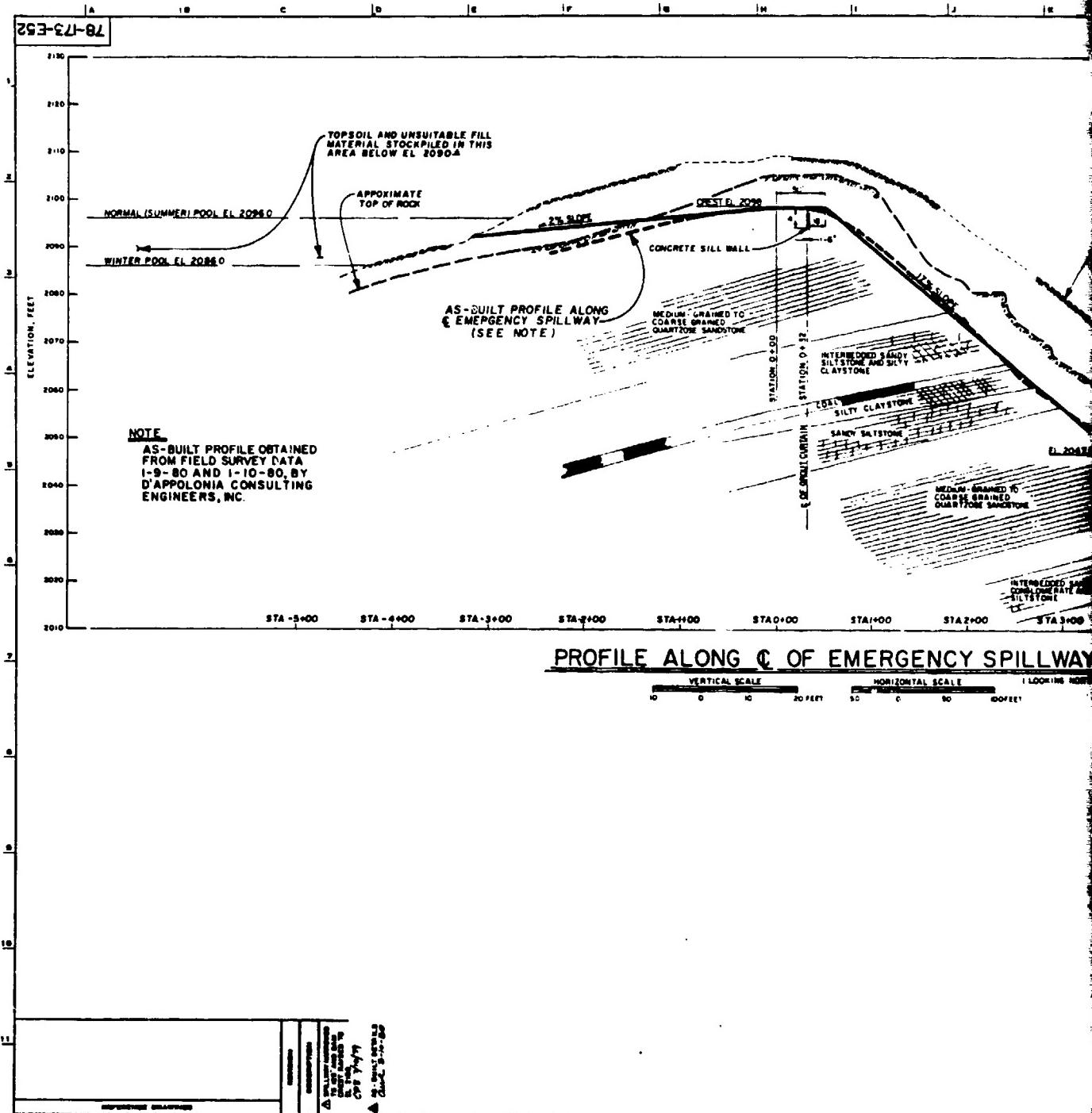


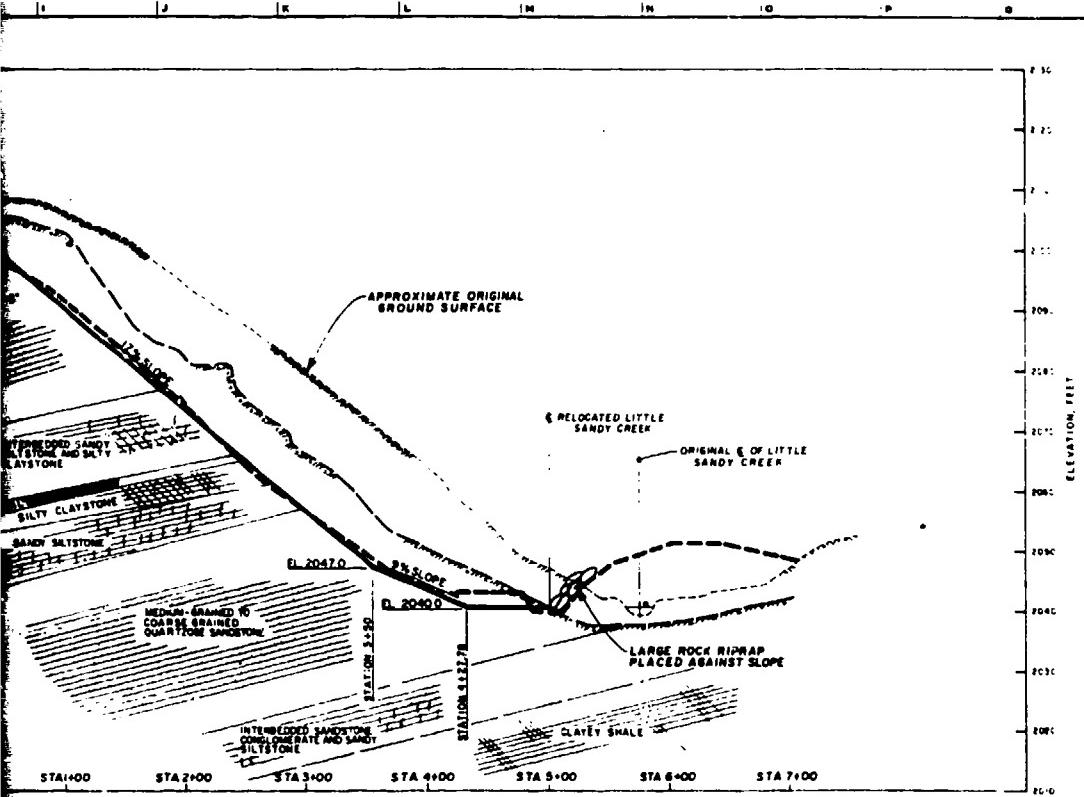
SHEET II OF 65



CONSULTANTS, INC.

FIGURE 5





EMERGENCY SPILLWAY

HORIZONTAL SCALE (LOOKING NORTHEAST)
50' 0" 50' 0" (0FEET)

NOTE:
FOR AS-BUILT SURVEY SECTIONS OF
EMERGENCY SPILLWAY, SEE DRAWING
78-173-E52

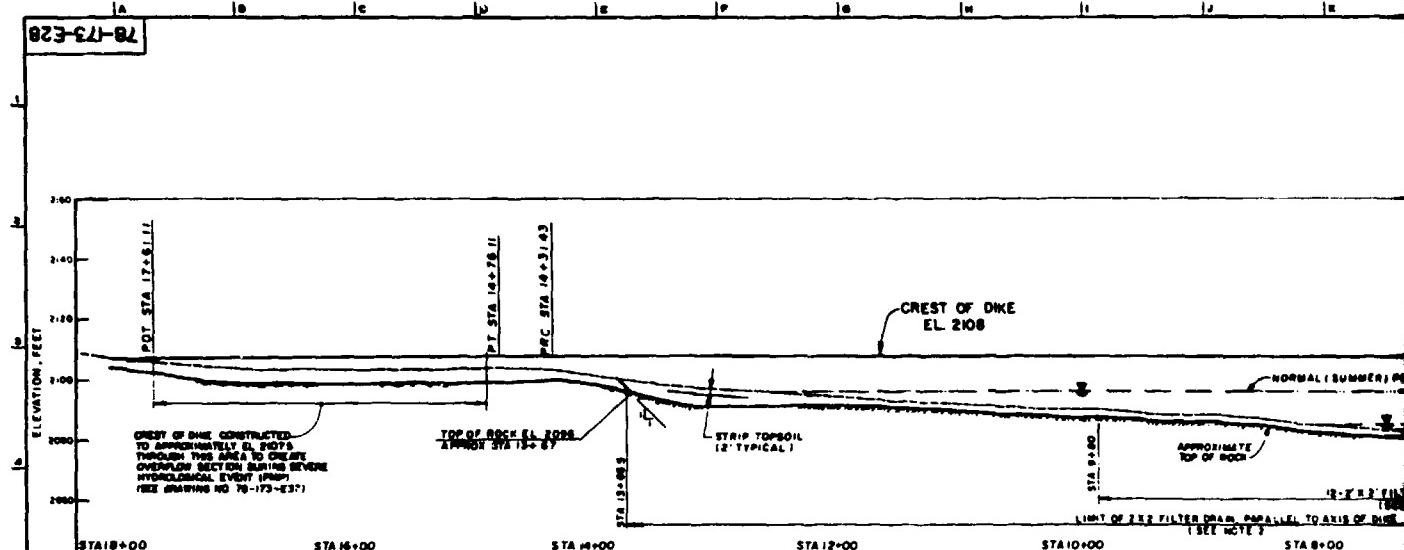
DAPPOLEONIA		
ALLIANCE, NEBRASKA BOY SCOUTS OF AMERICA HERITAGE PRESERVATION TAYLOR COUNTY, NEBRASKA		
PROFILE A - EMERGENCY SPILLWAY		
DRAWN BY	0-000-0	0-17-00
CHECKED BY	0-000-0	78-173-E52
SUPERVISED BY		

SHEET 2 OF 25



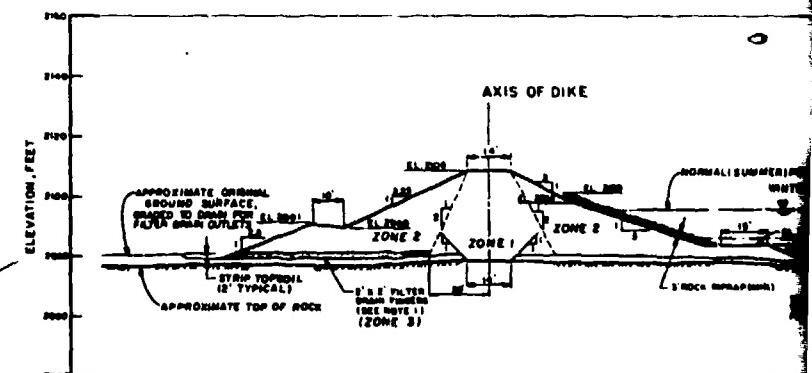
FIGURE 6

12

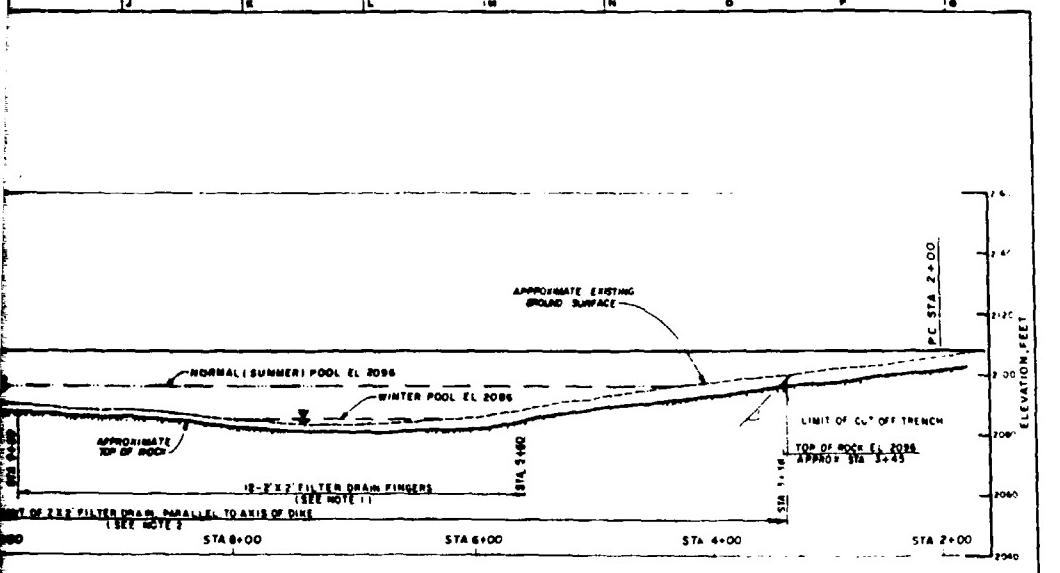


PROFILE AT CENTERLINE OF DIKE

A horizontal scale bar at the bottom of the page. It features two sections: 'VERTICAL SCALE' on the left and 'HORIZONTAL SCALE' on the right. The vertical scale has markings at 20, 0, 20, and 40 FEET. The horizontal scale has markings at 50, 0, 50, and 100 FEET.



TYPICAL SECTION THROUGH DIKE



CENTERLINE OF DIKE

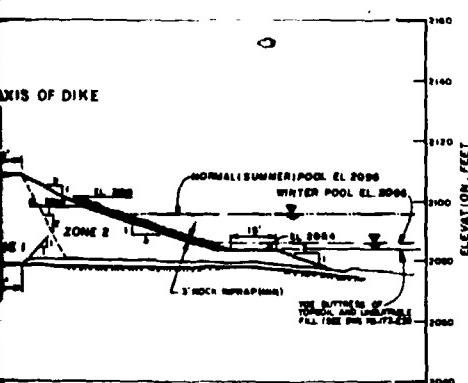
HORIZONTAL SCALE

0 50 100 FEET

ZONE 1 - SELECT MATERIALS FROM BORROW AREA
ZONE 2 - COMMON EXCAVATION MATERIALS
ZONE 3 - DRAIN MATERIAL

NOTES

- 1 THE 18'-X-2' FILTER DRAINS WERE EXCAVATED IN STRIPPED GROUND FOR PLAN AND ARRANGEMENT SEE SHEET 70-173-E27
- 2 2-X-2' FILTER DRAINS PARALLEL TO DIKE AXIS WAS EXCAVATED IN STRIPPED GROUND AND WAS EXTENDED UP THE ABUTMENTS TO EL 2096 SEE SHEET 70-173-E27 FOR PLAN AND ARRANGEMENT



THROUGH DIKE

0 20 40 FEET

DAI PDI CONSULTANTS		
ALLEGHENY THALIA COUNCIL BOY SCOUTS OF AMERICA HERITAGE RESERVATION FAYETTE COUNTY, PENNSYLVANIA		
PROFILE AT CENTERLINE OF DIKE AND TYPICAL SECTION		
DESIGNED BY:	ACN:	5-9-79 DRAWN BY:
SUPERVISED BY:		5/4/79 70-173-E28
APPROVED BY:	1 2	5/1/79

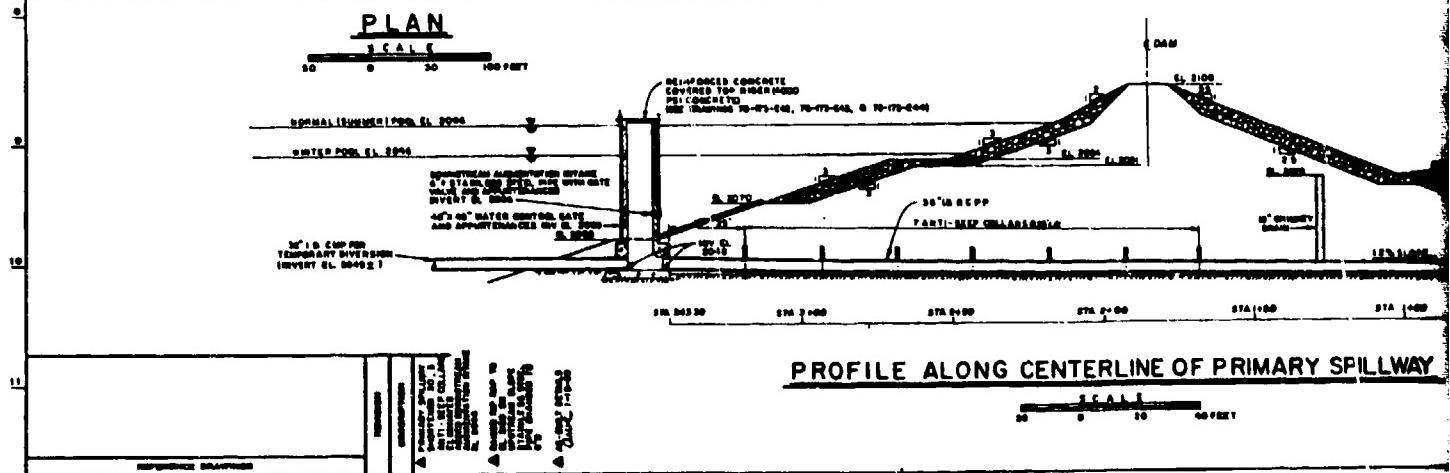
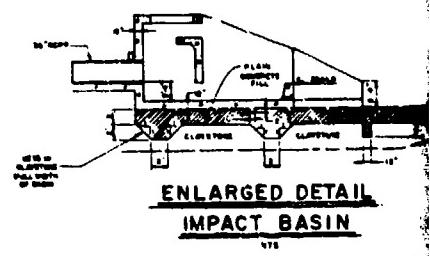
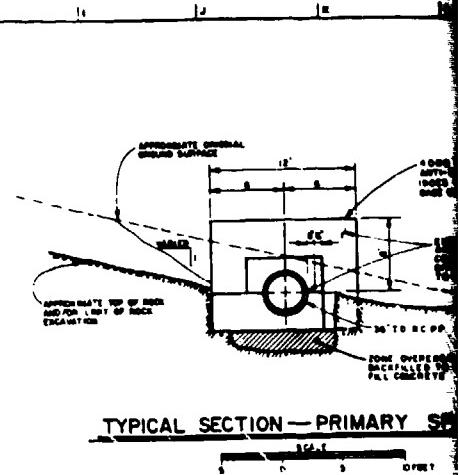
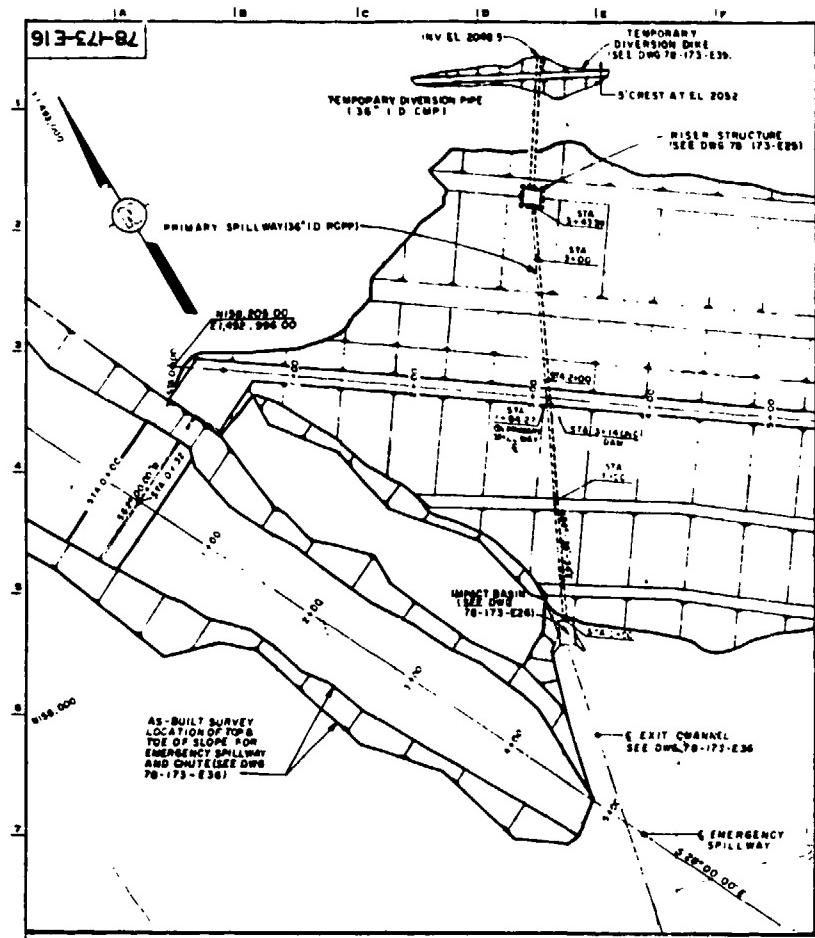
SHEET 14 OF 65

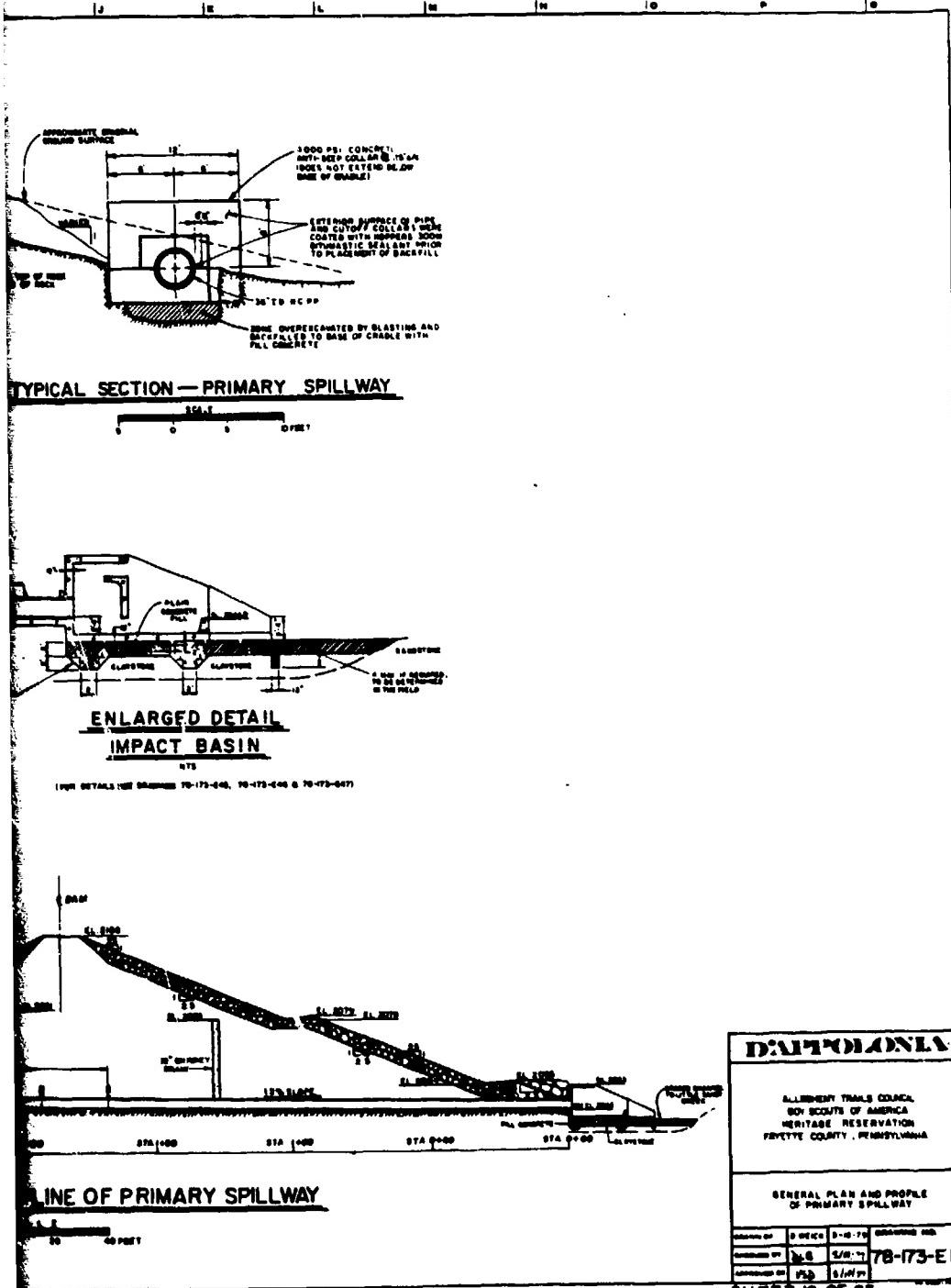


CONSULTANTS, INC.

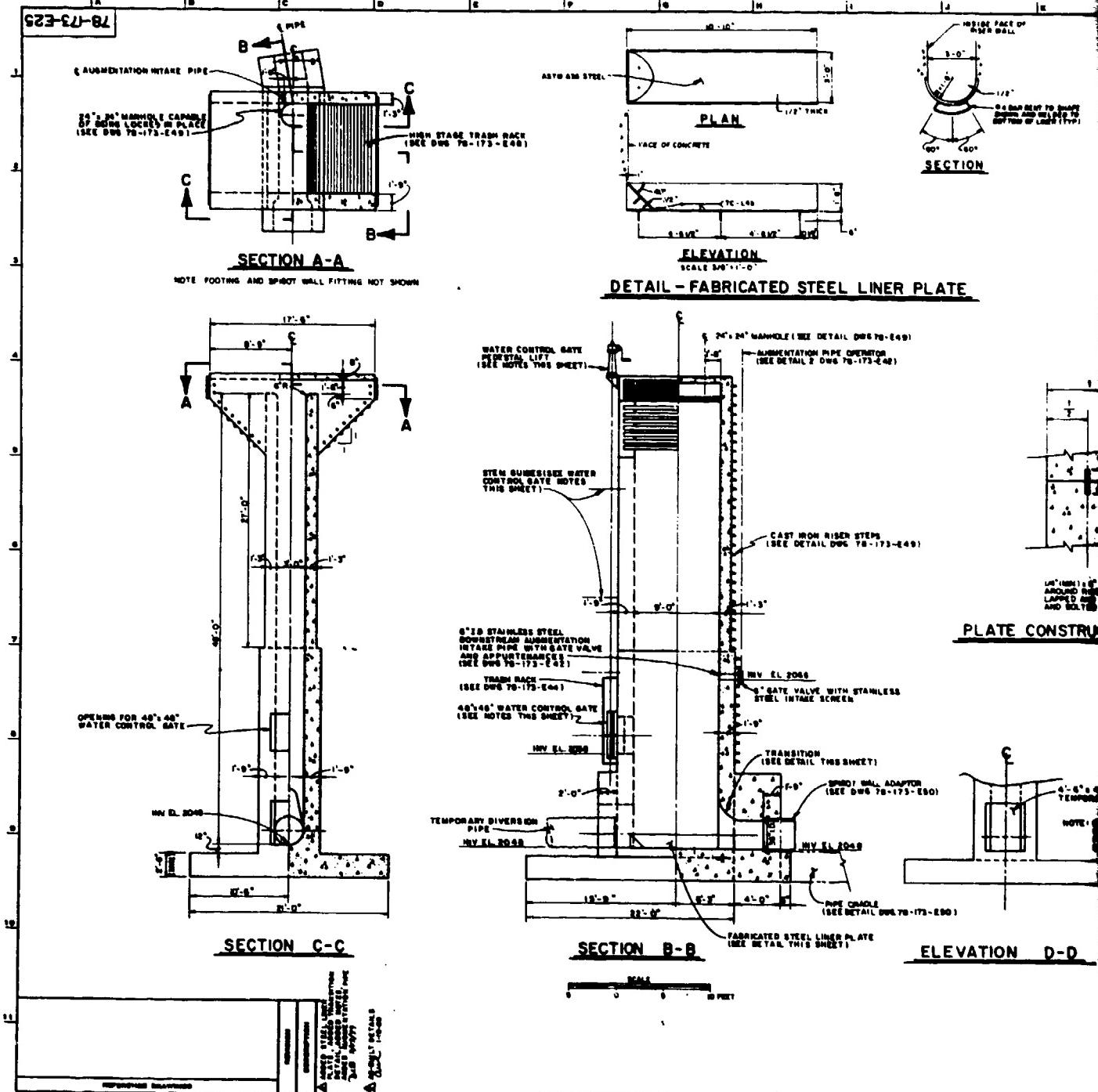
FIGURE 7

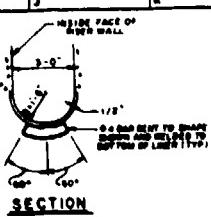
1 W





gai
CONSULTANTS, INC.
FIGURE 8





WATER CONTROL GATE NOTES

- 1 48" x 48" AMICO MODEL 5820 HEAVY DUTY SLICE GATE
- 2 T-77 TYPE WALL THIMBLE 12" DEEP, 48" x 48" SQUARE BEVEL
- 3 CRANK OPERATED ENCLOSED BEAN PEDESTAL LIFT, AMICO MODEL CPE-12 48" x 48"-10 WALL BRACKET W/ BRONZE LIFT RUT
- 4 4-STEEL GUIDES, TYPE 1A SPACED EVENLY AT 70 1/2" AND 2 1/2" Ø STAINLESS STEEL AND CARBON STEEL RISING STEM
- 5 GATE SHALL BE INSTALLED ACCORDING TO MANUFACTURERS RECOMMENDATIONS
- 6 DISTANCE FROM C OF GATE TO TOP OF SLAB = 36"

INNER PLATE

000-70-149
000-70-150

000-70-173-249

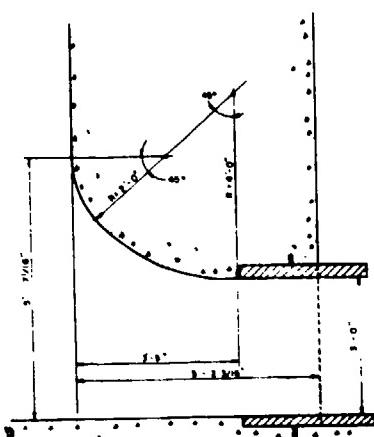
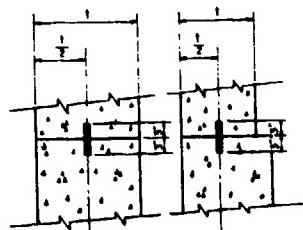


PLATE CONSTRUCTION JOINT DETAIL(TYP.)

STAINLESS

SHEET 1

000-70-173-250

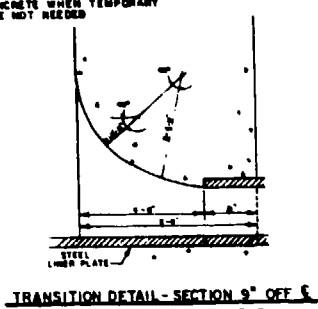
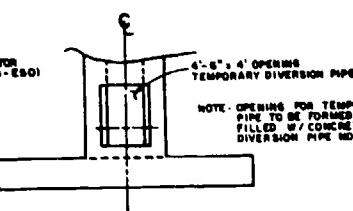
000-70-173-251

000-70-173-252

000-70-173-253

TRANSITION DETAIL - SECTION ON C PIPE AT RISER DISCHARGE

SCALE 0 2 FEET



ELEVATION D-D

TRANSITION DETAIL - SECTION 9' OFF S PIPE AT RISER DISCHARGE

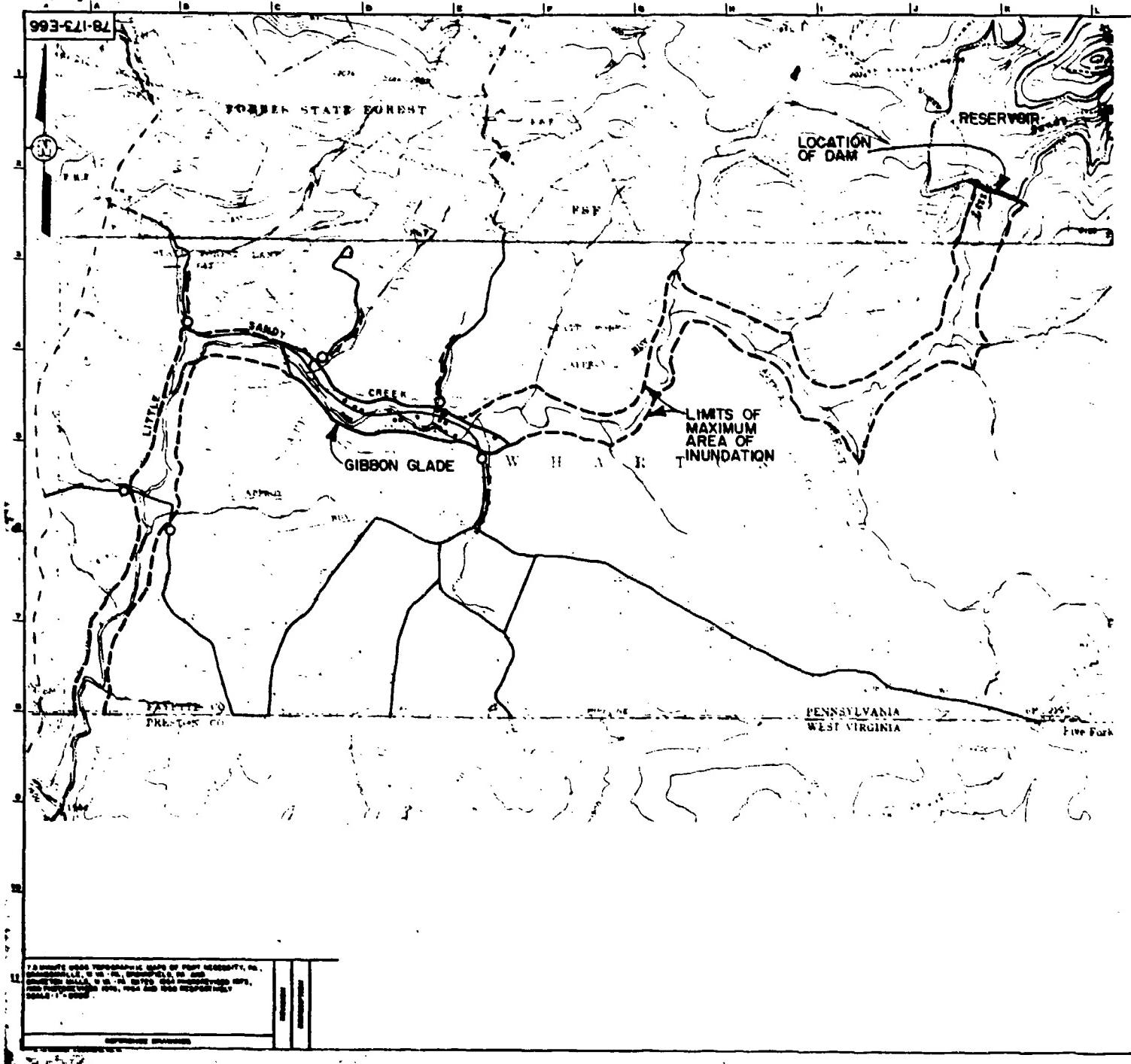
DAITOLONIA		
ALLIANCE TRAILS COUNCIL BOY SCOUTS OF AMERICA HERITAGE RESERVATION FAYETTE COUNTY, PENNSYLVANIA		
PRIMARY SPILLWAY RISER PLAN AND ARRANGEMENT		
SPILLWAY NO.	DATE	DRAWING NO.
100	5/4/71	70-173-E25
VSD	5/4/71	
VSD	5/4/71	

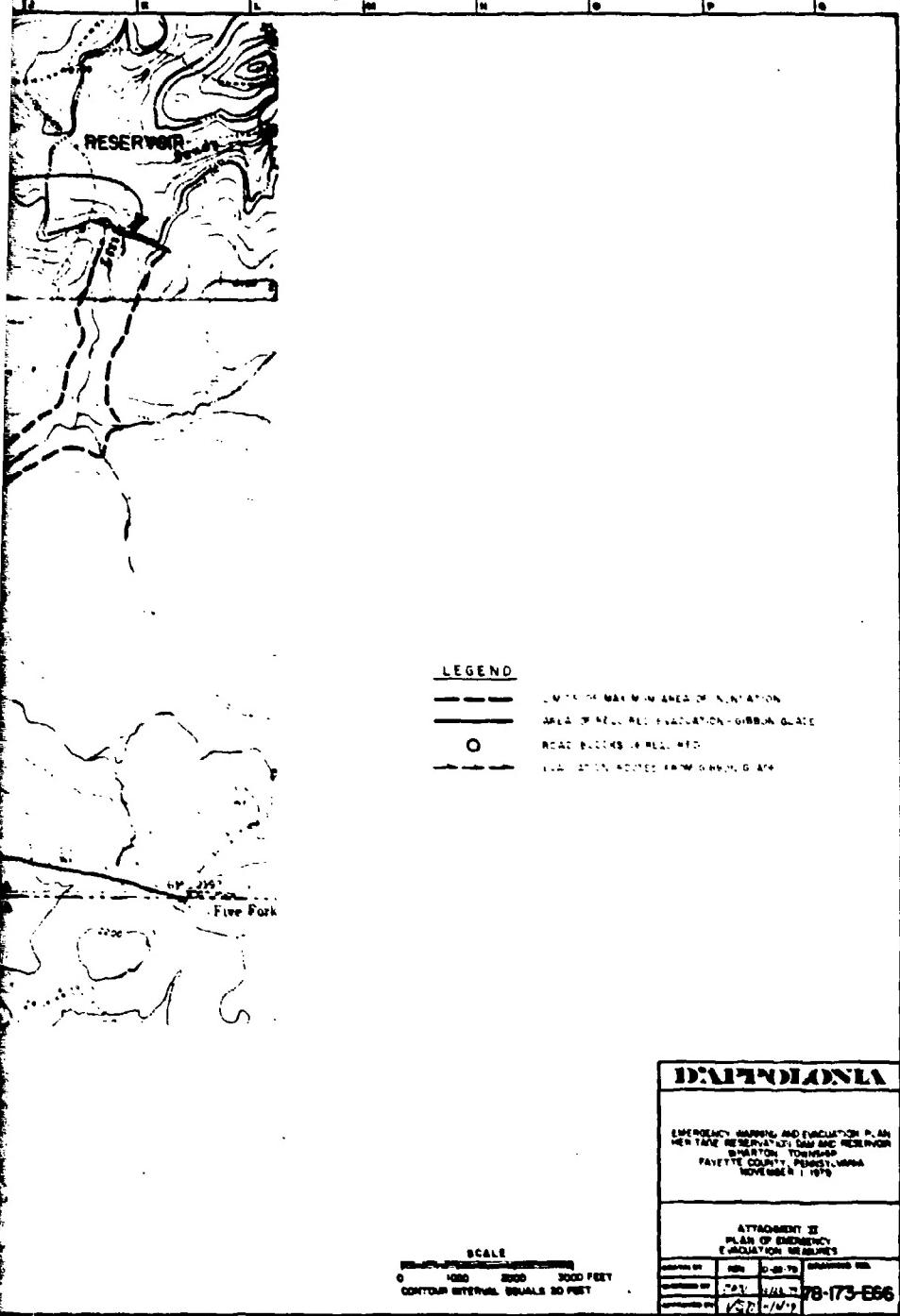
SHEET 17 OF 65



CONSULTANTS, INC.

FIGURE 9





APPENDIX F

GEOLOGY

Geology

Heritage Reservation Dam is located in the Allegheny Mountain section of the Appalachian Plateau physiographic province and lies about 4 miles south of Farmington, Pennsylvania. The site is situated between 2 of the major northeast to southwest trending anticlines typical of the section, Chestnut Ridge to the west and Laurel Hill to the east. More specifically, the site is located on the western flank of the Laurel Hill Anticline. Strata exposed along the crest of Laurel Hill are generally Devonian and Mississippian in age, whereas along the flanks of Laurel Hill, the strata are generally Mississippian and Pennsylvanian in age. In the vicinity of the dam and reservoir, hilltops and upper valley walls commonly contain strata of the Conemaugh Group, whereas the lower valley walls and valley floors are underlain with strata of the Allegheny Group, which are middle to lower Pennsylvanian age, respectively.

The Laurel Hill Anticline has a strike of approximately N30°E locally. Strata underlying the steeper flank of this structure have a maximum dip of approximately 12 to 15 degrees to the northwest.

Because the folds in this area are asymmetrical in nature, the rock strata along the western boundary of the site have a strike of about N35°E and a dip of about 3 percent (1.5-2.0°) to the northwest; whereas along the eastern side of the site the rock strata strike at about N52°E and dip at approximately 0.6 percent (0.5 degree) to the northwest.

The following discussion regarding rock fracturing, groundwater, topography and surface soils in the immediate vicinity of the dam has been taken from D'Appolonia's "Design Report".

"In addition to the gentle folding, the limited amount of stress to which the rocks have been subjected has resulted in fracture zones constituting permeable conduits for groundwater movement. The fracture zones are generally oriented N2°W, N78°E, and N50°W, and are nearly vertical.

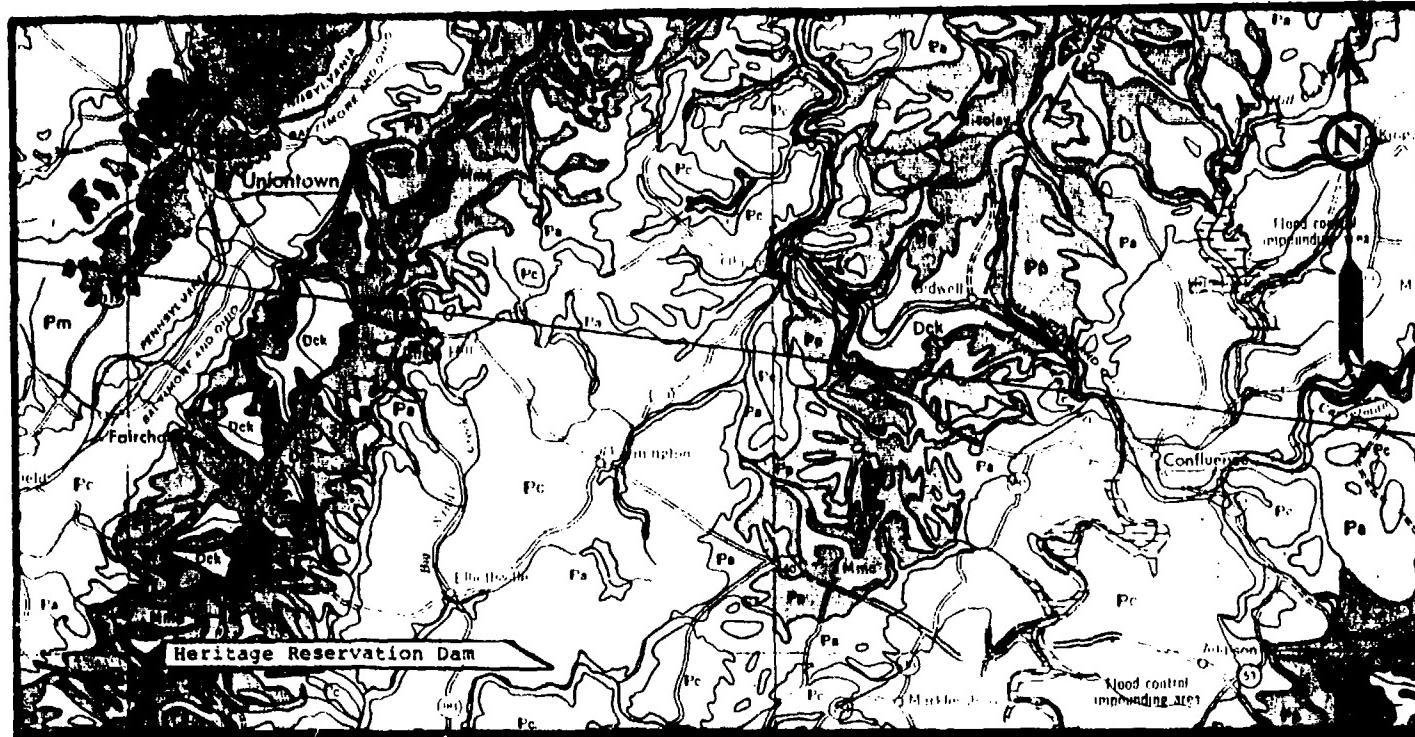
The site topography in the vicinity of the proposed dam consists of asymmetrical valleys with the west slopes being steep and the east slopes being gently. This topography is a direct result of the past uplifting and folding of bedrock and subsequent erosion and dissection by rainfall runoff. The surface slopes vary from 0.25 to 0.50 percent along the valley floor to approximately 60 percent along the hillsides.

The soils of this upland area have been formed from weathering of the bedrock materials which include sandstone, siltstone and shale. The thickness of the soil overburden varies from as little as 2 to 3 feet to as much as 6 to 8 feet with the thin overburden typically overlying the sandstones and the thicker overburden generally overlying the shales. The soils are generally residual silts and

clays of low plasticity and are often sandy and contain rock fragments, depending upon the parent rock stratum from which they have been weathered. Clay content generally ranges from approximately 10 to 30 percent by weight and can be as high as approximately 50 percent in isolated areas. The silt content of the soils typically ranges from approximately 18 to 40 percent by weight; the sand content generally ranges from 20 to 50 percent by weight; and the gravel content generally ranges from about 1 to 5 percent by weight. Natural water contents are typically between 12 and 18 percent, but can be higher in isolated areas. A more detailed discussion of the on-site soils and subsurface conditions at the dam site are presented in Section 4.0."

References:

1. D'Appolonia Consulting Engineers, Inc., "Design Report, Proposed Dam and Reservoir", Heritage Reservation, Wharton Twp., Fayette County, PA., May 1979.
2. Hickok IV, W.O. and F.T. Moyer, Geology & Mineral Resources of Fayette County, Pennsylvania, Pennsylvania Geologic Survey, Fourth Series, Bul. C-26, Harrisburg, 1940.



LEGEND

PERMIAN AND PENNSYLVANIAN

Washington Formation

Cyclic sequences of sandstone, shale, limestone and coal; some red shale, some mineable coal; base at the top of the Waynesburg Coal.

PENNSYLVANIAN

APPALACHIAN PLATEAU

Pm

Monongahela Formation

Cyclic sequences of sandstone, shale, limestone and coal; limestone prominent in northern outcrop areas; shale and sandstone increase southward; commercial coals present; base at the bottom of the Pittsburgh Coal.

Pc

Conemaugh Formation

Cyclic sequences of red and gray shales and siltstones with thin limestones and coals; massive Mahoning Sandstone commonly present at base; Ames Limestone present in middle of sections; Brush Creek Limestone in lower part of section.

Pa

Allegheny Group

Cyclic sequences of sandstone, shale, limestone and coal; numerous commercial coals; limestone thicker westward; Vandalia Limestone in lower part of section; includes Freeport, Kittanning, and Clarion Formations.

Dck

Pottsville Group

Predominantly sandstones and conglomerates with thin shales and coals; some coals mineable locally.

MISSISSIPPIAN

Mauch Chunk Formation

Red shales with brown to greenish gray fluey sandstones; includes Greencastle Limestone in Fayette, Westmoreland, and Somerset counties, Logatanna Limestone at the base in southwestern Pennsylvania.

Pocono Group

Predominantly gray, hard, massive, cross-bedded conglomerates and sandstones with some shale; includes in the Appalachian Plateau, Burgon, Shannan, Cuyahoga, Conewago, Corry, and Kopp Formations; includes part of "Oswayo" of M. L. Fuller in Potter and Tioga counties.

DEVONIAN

Catskill Formation

Chiefly red to brownish shales and sandstones; includes gray and greenish sandstone tongues named Elk Mountain, Honesdale, Shokola, and Delaware River in the east.

Scale

0 2 4 6 8 10 MILES

GEOLOGY MAP

REFERENCE:

GEOLLOGIC MAP OF PENNSYLVANIA PREPARED
BY COMMONWEALTH OF PENNA. DEPT. OF INTERNAL
AFFAIRS, DATED 1960, SCALE 1" = 4 MILES

GAI
CONSULTANTS, INC.